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Changing energy futures: A systems approach to the adoption of energy alternatives in New Hampshire

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CHANGING ENERGY FUTURES: A SYSTEMS APPROACH TO THE ADOPTION OF ENERGY ALTERNATIVES IN NEW HAMPSHIRE

BY

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DISSERTATION

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To Erin
With the hope that her future
is renewable.

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ABSTRACT

CHANGING ENERGY FUTURES: A SYSTEMS APPROACH TO THE ADOPTION OF ENERGY ALTERNATIVES IN NEW HAMPSHIRE

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In an attempt to develop a comprehensive approach to the study of the adoption of energy systems, this dissertation first critically examines a variety of approaches to this phenomenon, including market models of adoption, the adoption of innovations literature, and the social psychology of attitudes and behavior. Market models are seen as generally reductionistic and the argument is made that they fail to take into consideration a variety of non-cost considerations. The assumption here is that while price considerations play a role in this process, decisions are also affected by values and attitudes which are not directly incorporated into market models. A general model of adoption is developed which incorporates situational variables, decision factors, and individual characteristics.

This model provides the basis for an analysis of data obtained through a survey of homeowners in the state of New Hampshire. Respondents in the survey are separated into three basic groups: those who have actually made an active decision to purchase an energy system (adopters), those who have thought about purchasing a nonconventional system and then decided against such a purchase (aware nonadopters) and those who have never thought about purchasing any sort of energy system (unaware nonadopters).

The model is used in six different logit comparisons: centralized versus decentralized adopters; aware nonadopters versus, first, solar adopters and, secondly, wood adopters; all nonadopters compared to all adopters; and unaware nonadopters compared to, again, solar adopters and then wood wood adopters. While the results vary for each comparison, generally they demonstrate that: a) demographic variables do not help us to understand the differences between these groups; and b) while some type of price consideration plays a role in these analyses, non-cost considerations like a desire to be independent or the amount of exposure to alternatives are also very important in helping us to understand this process.

CHAPTER 1

ENERGY AS A SOCIAL PROBLEM

Introduction

Our contemporary history is filled with examples of environmental problems. Much of what we once took for granted has become increasingly problematic. Clean air, clean water and abundant food supplies have been replaced by smog, acid rain, toxic pollution of our land and drinking water, mercury and dioxin-laden fish, PBB-riddled cattle, and periodic energy shortages. The increasing public concern about these issues has not been readily translated into solutions. Political debate has consistently broken down into opposing camps, in particular, those who favor increased regulation of the market and those who want to free up the market and give more incentives to economic growth.

The environmental movement, in turn, has become more diverse. There has been a growing realization that these problems call into question some of the basic underlying assumptions regarding the relationship between our political and economic systems. This theoretical formulation has led to a call for more radical reforms which challenge basic property rights -- in particular as they pertain to air and water pollution -- and the social organization of

production, including the distribution of the costs and benefits associated with the methods of industrial production currently found in both capitalist and socialist economies. But the movement has been unable to decide on strategies, as reflected in the perpetual conflict over whether to make changes by working within the political system or to demand more radical transformation of the political and economic systems of modern states. Some individuals prefer the moderate reforms of the environmental lobbyists, arguing that we can't afford to wait for more radical reforms. Other people tend to support the ideology and strategy associated with Green politics. Still others work outside of the system with groups such as Greenpeace or Earth First or propose the more radical changes associated with bioregionalism.

This dissertation is designed to be an exploratory study of the spread of what are variously called appropriate, decentralized, or nonconventional technologies. This is a phenomenon which challenges one of the basic tenets underlying our process of industrialization -- the centralized control and distribution of energy. While this centralization can be seen in varying degrees, the tendency in the post World War II United States has been to rely increasingly on forms of energy which are controlled, either in their price or in their marketing, by large corporations and utilities. We all recognize the monopolistic control of electricity production by public utilities, but we fre-

quently fail to recognize the variety of ways that other forms of energy are centrally controlled. For example, while home heating oil may appear to be a decentralized form of energy (there are a lot of distributors in every region), its price is determined more by large corporations through their control of the amount of oil that is refined than it is by local levels of demand (which are relatively inelastic) or the competitiveness that might exist between local distributors.

During the past decade or so, there has been a noticeable expansion in the use of decentralized energy technologies. The growth of this movement is the product of a variety of forces operating on both the macro level of social systems and the micro level of individual decisions. This dissertation will focus on the latter, examining the variables which seem to be important in helping us to understand the decisions made by individuals regarding the type of home heating systems they will use. These subjective decisions are based on expectations, values, and emotions as well as rational considerations. But these factors are also constrained by the institutional and cultural framework within which decisions are made.

Much of the emphasis of the contemporary environmental movement has been devoted to an examination of the relationship between energy and production. The concern has been with the environmental impacts of production, the spiral of increasingly greater levels of production and

consumption, and the social costs of that production. As a central part of this examination, the movement has become increasingly concerned with the centralized control of energy and has begun to look for ways to facilitate the spread of decentralized technologies. Such diffusion is, naturally, dependent upon a variety of considerations, many of which will be examined in this dissertation.

This emphasis, however, has not always been prevalent in the movement. To fully understand the importance of energy issues to the movement in general, we must look at the historical development of environmentalism in the United States. The next few sections are intended to give a brief summary of the movement, not necessarily in terms of its strategy but in terms of the evolution of one ideological wing of the movement: the appropriate technology movement. The purpose is to show the growing awareness of the centrality of energy issues to the movement as a whole, the way that a focus on alternative technologies has enabled the members of the movement to address criticisms that have been leveled at environmentalists, and to provide a basis for understanding the argument about the importance of environmentally benign energy systems to the future of our society. In this way we can place the individual decisions made by homeowners into a larger social context.

From Conservation to Environmental Reform

Frequently, when we think of environmentalism we tend to equate it with conservation. Certainly this is understandable. America has a long history of environmental concern, and the environmental movement is indebted to the conservation movement for its intellectual roots, its early leaders and organization as well as the resources which were necessary for its initial mobilization (Morrisson, 1980). But the movement has always been, and remains today, much more complex and more diverse in its orientation.

To begin to understand the early development of the movement, we need to examine the historical context that gave it birth. We need to look more closely at the larger social changes that have led to increased environmental degradation.

During the first 50 years following the establishment of the United States, the prevailing political philosophy was Jeffersonian in nature. Agriculture was seen as the foundation of the country's wealth. The American vision was of a nation of small farmers, each independent from the others, thus facilitating the psychological and economic independence which were prerequisites of democracy.

On the other hand, there was a growing recognition of the importance of manufacture. States were often eager to create a climate that was favorable to economic expansion.

But, at the same time, they "found 'manifestly erroneous' the notion that individuals should be left alone, that the people individually, and not the government, 'are the judges of the interests, and consequently should be allowed to regulate them unobstructed'" (Handlin, 1969). The state would play a role in every part of the economy. It would abet commerce and industry as long as the activity was in the public interest, but it would also regulate the industry, especially through periodic inspections, to make sure that interest was not abused. (Of course, such practices also added prestige in foreign ports so that products sold better.)

During the next 50 years, the trend was toward a greater extension of governmental rights to private industry in order to advance the public good (Handlin, 1969). But there was also a healthy fear that if corporations were allowed to develop and roam the country at will, then they would become vast trusts for the accumulation of wealth. This in turn would undermine political participation and decision making. Thus, a variety of laws were enacted to limit this power. These included attempts to place limits on the amount of real property that a corporation could own, the amount of time that they could exist, as well as the number and types of enterprises in which they could be involved. At times, the states made the corporations subject to periodic audits. All of these regulations were based on the recognition that while corporations were

necessary to advance the public interest, they were also real actors in the political and economic realm which, by nature, lacked any conscience. They might, then, use their power and influence to undermine democratic processes and to limit competition in the economy (Berle, 1957).

These restrictions were subsequently abandoned. To facilitate the westward expansion via the railroads, it was necessary that companies be allowed to purchase vast tracts of land and, in order to assure adequate payback, that they be allowed to exist for long periods of time. Without this, no private individuals would risk the investment that was needed.

This led to a general trend of increased privatization of environmental resources and property rights. Individuals and corporations were granted ownership of, or ceded property rights to, vast tracts of public lands. As a result, resources were depleted with no concern for future needs or for the impact on the environment as a whole.

In response to this, two distinct conservation movements arose. The first of these, which is most often identified with Gifford Pinchot, argued that our wilderness areas and natural resources were a public heritage and these resources should be placed in trust with the federal government acting as steward to assure that these resources be used for the greater public good. Their vision of a "public" was similar to Burke's (incorporating many generations) and they felt that the long term interests of the

society were being undermined by a short-term profit motivation that was leading businessmen to plunder the environment. This overconsumption of resources threatened the long-term well-being of the nation (O'Brien, 1983). They believed further that the public interest could somehow be objectively determined by a scientific and administrative elite in the employ of the federal government (Andrews, 1980)

On the other hand, there was a small group of people concerned with preserving the pristine beauty of the natural environment for its own sake. These preservationists believed that much of our lands should be set aside for their aesthetic value and the appreciation of future generations. Their concern was not with facilitating future production. Rather, they viewed the environment not simply as a means of subsistence for modern people but as something to be enjoyed in its own right. (O'Brien, 1983)

Such diverse views of the environment quite obviously placed the preservationists and the conservationists at odds. This points to a basic fallacy in the approach of the conservationists since it is impossible to identify a single, unitary public interest (Andrews, 1980). Furthermore, while Pinchot recognized that the gravest threat to the environment was the alliance between business and the government, it seems idealistic to assume that bureaucratic administrators could be made less subject to political pressure or to the exercise of power and influence by cor-

porations or that scientific neutrality and objectivity could be maintained. Eventually, each of the bureaucracies charged with protecting the public interest developed political ties with the corporations which stood to gain the most from the exploitation of these resources.

The majority of the political battles were won by the conservation wing of the movement. This gave the environmental movement of the pre World War II era a distinctly conservative tone, oriented toward the use of natural resources for long-term production and, notably, the building of dams for electrical power. (In fact, the last major battle fought between Muir and Pinchot was over a dam proposed for the Hetch-Hetchy Valley in Yosemite.)

The movement at this time did not possess a radical orientation, despite Pinchot's recognition of the collaboration between politicians and businessman. There was no attempt to confront the existing political and economic system. Rather, many of those involved in the movement came from the political and economic elite. The "public interest" was served through a sort of bureaucratic logrolling of the interests of these elite.

By the 1960's there was an increasing recognition that our current practices were having serious negative repercussions on the environment. The publication of Rachel Carson's Silent Spring (1962) heightened the awareness of the general public to the extent of environmental problems, especially the effects of DDT on the food chain. At the

same time, there was a growing realization among environmentalists that there could be no assurance of action on the part of the federal government. The government was doing little to ameliorate the problems in our urban areas, the negative impacts of industrialization, or the intensifying issues surrounding the outdoor environment. There was heightened distress over air and water pollution and an accruing disquietude over such issues as pesticides, open spaces, wildlife, and soil preservation (Andrews, 1980).

A variety of factors led to the coalescence of this awareness into an environmental movement. The political climate of the 60's was of prime importance. Idealistic youths of the post-Kennedy era were looking for ways to change society. They began to focus on the fact that while people were increasingly able to afford the time and expense necessary to enjoy the environment, they found their endeavors to be increasingly less rewarding. The other factor was the growing tendency on the part of the judiciary to insure that all interests, not just economic claims, were evident in administrative decisions (Andrews, 1980). The latter was characteristic of decisions in the civil rights and the women's rights issues as it was of environmental decisions.

At the core of this movement were people who were well aware of the role that power plays in political decisions, including many young lawyers who were inclined to use liti-

gation to prevent undesirable courses of action. The advantage of such a strategy was that even if it failed it still served to enhance the availability of information and to draw media attention.

These core activists were convinced that voluntary participation would never lead to solutions to our environmental problems. They recognized that federal agencies (e.g., the TVA, the Soil Conservation Service, the Bureau of Reclamation, and the Army Corps of Engineers) were a fundamental part of the dilemma. The ability of these bureaucracies to carry out their agenda was directly dependent upon their ability to exclude a variety of actors and interests from decisions.

The enactment of the National Environmental Policy Act (NEPA) on January 1, 1970 provided a valuable tool for these activists. By requiring federal agencies to consider non-monetary consequences and to make complete documentation of all impacts available to the public, it extended to all interested parties the ability to challenge the underlying assumptions and goals of the agencies involved (Andrews, 1980).

At their best, these administrative reforms allowed environmentalists to halt some of the most abhorrent environmental practices (e.g., the use of DDT) and to challenge potentially harmful policies. The conflictual nature of this approach inherently involved compromises. Increased costs of goods, fewer jobs, lower levels of produc-

tion, reduced energy efficiencies, etc. were all seen as the price which had to be paid to protect the environment. Success in this endeavor depended upon continued public support for these trade-offs. This necessitated that environmentalists be able to offset the information disseminated by corporations; information that was intended to sway public opinion in the reverse direction. Following the 1973-74 oil embargo, the associated entrenchment of stagflation changed the context of this debate.

Energy and the Environment

Even prior to 1973, the environmental movement had been increasingly susceptible to claims made by its opponents that this was an elitist movement, consisting primarily of members of the upper class who were unconcerned with the regressive impacts of environmental legislation (Morrison, 1980). Environmentalists were pictured as being more concerned with scenic beauty than dams, more worried about oil spills than offshore oil development, as being for "planned scarcity" (Schnaiberg, 1980), all of which tended to raise prices of essential goods and impose disproportionate costs on the poor and working class. Environmentalists, it was argued, are pro-nature and anti-people. While such arguments may or may not have reflected the views of the "silent majority", they made political victories more difficult.

Following the Arab oil embargo, the subsequent debate over energy policy seemed to break down into two camps: those who saw certain limits to growth versus those who favored continued expansion, or what Schurr has referred to as the limitationists and the expansionists (Schurr, et al, 1979). The expansionists' point of view was essentially that progress in the industrialized world is identified with the increased consumption of material goods. This consumption has been tied to vastly expanded use of energy. The use of wind, water and wood has been replaced by a reliance on fossil fuels to maximize the efficiency of the production process (which might be connected by some with to the marginal productivy of capital) since in the period following World War II industrialists felt (without any empirical support) that it was cheaper to rely on technological innovation than it was to continue to rely on increasingly expensive labor. Our continued growth was dependent upon our ability to find additional fossil fuels. Finite limits to these fuels was not a major consideration. Over the long run, science and technology would be able to develop new energy systems long before supplies were depleted or became prohibitively expensive.

The limitationists' view is based on the assumption that the world's resources are finite and for that reason it is impossible to imagine continued consumption at the present rate. To do so would inevitably lead to unacceptable consequences. We must, they argued, begin to

limit growth, in particular the conspicuous consumption of the affluent minority in the industrialized world. This approach drew strength from the first report to the Club of Rome by Dennis and Donella Meadows, The Limits to Growth. Their computer simulation of the world system found industrial growth to be the most de-stabilizing of all the world's problems -- greater even than population -- since it affects so many variables in their model: natural resource usage rate, the availability of capital, pollution, etc. They further argued that we are living in a golden age and saw little hope that the developing countries of the world would be able to attain the standard of living enjoyed by the West. They also pointed out the inherent tendency of capitalism to expand exponentially, resulting in eventual overshoot and collapse unless we begin to limit the forces of growth.

There are a few critical differences that divide the two camps. First of all, there is the question of how long our current rate of growth can continue. Expansionists believe that science and technology can find new resources and develop new energy systems indefinitely. Limitationists feel that growth cannot continue and that it is necessary to critically examine our entire process of production.

The second difference concerns the consequences of growth. Expansionists argue that the negative consequences of growth are far outweighed by the benefits and that many

of the negative consequences are subject to amelioration. Furthermore, even the attempts to control some of the more blatant consequences of growth may have severe negative repercussions, such as the loss of jobs and economic decline. The limitationists believe that continued growth at our present rate can only result in the collapse of our entire system.

The third issue has to do with whether or not growth can lead to greater distributive equity. Expansionists presume that continued growth is a prerequisite to the extension of the good things in life to the majority of the world's population. Limitationists argue that you cannot deduce the welfare of individuals from aggregate statistic of production. Such indicators do not tell us the way in which the goods produced are distributed among the world's population. The extremely high levels of production that we have experienced since World War II, they would argue, have benefited a small minority of the world's population at the expense of the vast majority in the less developed countries.

Finally, there are differing views of the relationshi between people and nature. The expansionist viewpoint is person-oriented. Nature is a source of the commodities necessary for a better life. Limitationists feel that people are a part of nature. They take for granted that people should preserve nature, not just exploit it.

Dunlap and VanLiere (1978) see evidence of a paradig-

matic shift in our cultural view of the relationship between humans and nature. In the past, growth and progress have proceeded apace under what they term the Human Exceptionalism Paradigm (HEP). This approach envisions humans as unique because of their culture. Culture can vary more quickly than biological systems, giving people an evolutionary tool that puts them apart from and above nature. Culture has become a tool -- some might say an ecological niche -- and cultural accumulation allows progress to continue unabated. The New Environmental Paradigm (NEP) sees humans as simply one more species in the biotic community and recognizes that because of the links between ecosystems, there is no way to anticipate all of the consequences of our interactions with nature. NEP is a view of the world as a finite biological and physical system which places constraints on economic growth and progress.

There is another, even more fundamental dichotomy in our views of nature which bifurcates even environmentalists. According to Schnaiberg (1980) there are two differing meanings of "the environment". The first, the most common, is to simply regard the environment as a home. It is this conception which lies at the heart of our concerns with "fouling our own nest" or of discussions of "spaceship Earth". This is the approach which bolstered the environmental movement prior to 1974. It is difficult for anyone to be against a desire for clean air or clean water. This definition gave the movement a broad con-

stituency. It could easily cut across class lines. But an approach of this sort, while important, is superficial.

A more fundamental perception of the environment sees it as a basis of subsistence for the society. Such an approach forces us to consider all of the impacts which our methods of gaining sustenance will have on the environment, in terms of both environmental additions and depletions (Schnaiberg, 1980). This is an inherently more radical critique since it forces us to question the most fundamental aspects of productive and consumptive activity. Since energy in one form or another (including labor) is fundamental to all modes of production, we shall elaborate on Schnaiberg's point by turning to an examination of the relationship between energy and production.

Energy as a Basis of Social Production

Concern with the relationship between energy and society has a long history. Many theorists have concerned themselves with the importance of energy for society and for production. Spencer (1972), Cottrell (1955), Mumford (1966), Odum (1971) and others attempted to focus attention even prior to the oil embargo. Following the crisis, however, the debate began to focus on the ways in which energy use has affected society.

Commoner (1976) argues that our economic and environmental difficulties are inextricably intertwined with ener-

gy use. By relying on the first law of thermodynamics -- that the energy of the universe is constant -- as a basis for determining efficiency, we tend to focus on considerations such as the amount of heat lost over distance, insulation, etc. We have thus developed a blatant disregard for the second law of thermodynamics which informs us that while this energy may be constant, it does not necessarily exist in a usable form. Since the entropy of the universe is constantly increasing, while all of the energy in the universe exists it is increasingly, on average, in a more unorganized state. From the standpoint of the evolution of the universe we do not have to worry about attaining a maximum state of disorder in the near future. But from the perspective of societal systems of production, we must be concerned about the continued availability of energy resources in the near future. Once used, they are no longer available for further use even though they technically exist in some form. From this latter point of view, the most important consideration is that energy resources be matched to the task at hand in order to reduce the amount of waste (heat).

All physical systems in the universe are subject to these laws. Ecosystem production (the relationship between communities of organisms and their physical environment) is mediated by flows of energy through the system. As ecosystems change their environmental structure from simpler to more complex systems, their growth slows and they tend

towards a more stable, steady state where further growth is permitted only to the point where it offsets any surplus subsistence base. In fact, many systems grow to only about half of the potential limits of their physical environment. In this process of ecosystem production, materials circulate through the system of production within the limits imposed by the availability of energy.

Economies, societal systems of production, apparently -- but only apparently -- violate these basic laws. To the extent that human production systems are able to operate across ecosystems, rather than within them, they can appear to offset this tendency towards entropy. Yet human systems are still dependent on flows of energy and nutrients.

The key to this disparity is to be found in the way in which ecosystems and economies use their surplus. In ecosystems this surplus would be limited to the additional physical resources that would be available to additional populations. In economies, this surplus would include both physical resources and capital. As opposed to ecosystems, economies return only a portion of their surplus to increased consumption. The rest is funneled into tools and machines in order to increase the efficiency of production and the available surplus. This greater productive capacity and the rising expectations of consumers leads to exponentially increasing production (Schnaiberg, 1980).

Commoner (1976) sees this process as the basis of stagflation. Attempts to increase productivity in the

post-war economy have been dependent upon our use of technology. Increased reliance on this technology has displaced labor, thus contributing to unemployment. At the same time, since this machinery is dependent upon energy, the cost of goods produced must continue to increase as long as this energy is derived from non-renewable resources. In addition, the use of fossil fuels to generate this energy results in additions to the environment which are increasingly detrimental.

While this analysis may be only a limited explanation of stagflation, it at least illustrates a growing awareness of the pervasive effects of energy. Energy is the central driving force of production. Matter alone is not sufficient for production. It must be acted upon in some way. Energy is both a mediator of these transformation as well as a commodity in its own right. But the environmental withdrawals and additions that are associated with the extraction, transformation and disposal of materials inevitably meet the upper limits of any particular ecosystem. At these limits, either production must be limited or new ecosystems must be tapped. Even so, there are still upper limits to the thermal carrying capacity of the biosphere.

This exploitation of ecosystems for production leads to water pollution, toxic pollution, acid rain, smog, global warming, and a host of related problems. Our view of the earth as a "home" leads to meliorative attempts to

may more accurately be regarded as a bundle of rights, associated with these rights are obligations, primarily the obligation to leave that property in a usable condition for future generations. Capitalism, and to a certain extent socialism, have lost sight of the fact that economies exist to serve people. Capital and real property are social creations which exist to facilitate labor in the production of sustenance, not simply to further the accumulation of private capital (John Paul II, 1981; McPherson, 1977). Liberal democracies have tended to protect the rights of capital at the expense of labor and have tended to place less emphasis on the obligations which the ownership of capital entails.

A segment of the environmental movement has focused on this more radical critique of contemporary society. To the extent that environmentalists can demonstrate the dysfunctional nature of the centralized ownership and/or control of energy systems -- furthering inflation, unemployment, environmental degradation, conspicuous consumption -- then they are directly undermining the legitimacy of these means of production.

Our concern here is not to attempt to place greater blame on either socialism or capitalism for environmental degradation. The fact is that in both systems, decisions regarding the generation and allocation of resources are arrived at through bureaucratic organizations -- the one governmental, the other private. The nature of these deci-

sions varies greatly both between socialist and capitalist societies as well as among various socialist or capitalist societies. For example, the Soviet Union has demanded sacrifice from workers and consumers and has devoted much of its surplus to furthering production by building up its industrial base. On the other hand, China has, until recently, devoted a much larger share of its surplus to social welfare and attempts to raise the standard of living. On a world-wide scale, however, the argument has been made that equivalent levels of industrialization have generally resulted in similar levels of environmental degradation, both in terms of additions and withdrawals (Schnaiberg, 1980).

The point here is that we assume greater control by consumers in these decisions when they are made in market-oriented polyarchies. We all too often assume that since corporations must market products, they market what people will buy. But as Lindblom (1977) points out, this assumption is much too simple. There are a variety of factors the undermine this principle. Customers, for example, may be incompetent to choose, they may be hoodwinked, or the market may be rigged. We shall elaborate on this Chapter 2. For now, let us consider how market systems, like other forms of economic organization, ultimately put decisions into the hands of a few individuals who are able to exercise a great deal of discretion in what they produce. While they are concerned with what people will buy, the in-

centives built into the system encourage them to resolve such questions in terms of private profits rather than in the public interest. Lindlom argues that decision makers exercise discretion over a number of important areas: whether products will be dispersed by a few large firms or many small ones, the organization of the workplace, the types of technology employed, etc. Thus, major decisions are removed from the political agenda.

Of equal importance to the notion that markets are not popularly controlled is the question of just how much popular control actually exists in polyarchies. A host of literature in the social sciences attests to the influence of a corporate elite on political process (Mills, 1956; Domhoff, 1967,1983; Kolko, 1962). One need not assume any sort of conspiracy among the governing class, nor should we get bogged down in discussions of how many elite decision makers exist. To argue with Kolko's figure of 2500 top executives by adding the top executives of the next four corporations in each sector of the economy (thus raising the number to 4000) misses the point. The fundamental issue is also a basic sociological insight, as reflected in the work of Mosca, Pareto, Michels, Weber, and others. This is the understanding that in <u>any</u> complex system, the proximate decisions are made by only a few people (Lindblom, 1977). The correct question is whether or not these individuals are subject to polyarchic controls.

In all market-oriented polyarchies, business has a

privileged position. Political leaders grant incentives to business that are denied to other organizations. And executives bring a number of assets -- economic and organizational -- to the support of parties, interest groups, and electoral activities. Thus the processes are far less democratic that they appear. Not only do businessmen win when there are conflicting interests, they are able to shape these interests in the first place. The privileged position of business is legitimated through the media, the educational system, and other socializing institutions.

We shall elaborate on these points in Chapter 2. The point here is that much of the environmental literature misses the central argument regarding the expropriation of property and the distribution of costs and benefits associated with energy use, in particular the allocation of scarce resources. The distribution of scarce goods will always result in a political battle. Theorists since Plato and Aristotle have recognized this fact. But more contemporary theory has assumed that the growing surplus associated with industrial society would eliminate scarcity. Even Marx was optimistic about the ability of industrialization to eliminate poverty as long as the relations of production were altered. Such assumptions were easier to make in a time of resource abundance. But when even the air and the water of the planet have become scarce resources then we must recognize the changing nature of this controversy.

In reaction to this, a branch of the movement has developed an even more radical critique of contemporary society. What Devall (1980; Devall and Sessions, 1985) refers to as the deep ecology movement has drawn on the works of Gary Snyder, Theodore Roczak, Murray Boochkin and others in an attempt to develop a radical transformation of social organizations and values. More recently, this has evolved into bioregionalism, a movement designed to have regions live within their available resources (Sales, 1985). While it is a radically different metaphysical and epistimolgical framework, it has not developed a political-economic plan. This is a drawback for any movement and has characterized many of the discussions regarding the changing paradigms in modern society. But it is a serious failing because what we face is a real political battle over the distribution of scarcity -- a battle in which wealth and income lend some people an upper hand.

The publication of a variety of work in the post crisis era led to a new emphasis on the development of "appropriate technologies" as a solution to this fundamental problem. E. F. Schumacher's Small Is Beautiful (1973) presented to the developed countries a lucid framework for the advancement of these technologies.

From an entirely different perspective, the second report to the Club of Rome by Mesarovic and Pestel (1974) mounted a telling critique of the Meadows' earlier study. Their criticisms were founded partly on the assumption that

it was possible to change from the exponential type of growth exhibited by economies today to a more organic growth. Again the focal point was the extent to which production was based on renewable resources. They were aware, however, of the political dimensions of this process. They argued that the change was not possible without reductions in the disparities of wealth between the developed and the less developed countries. Without greater equality, there would be conflicts between the users and the suppliers of the world's resources as well as conflicts between short-term and long-term interests.

Morrison (1980) points out that environmental issues were never the primary concern of the appropriate technologies movement. However, technologies which degrade ecosystems are inherently unacceptable. The adoption of this framework by environmentalists provided a means of addressing the economic, political and social issues associated with development on a global basis. Implicit in this approach is a radical critique of contemporary systems of production and distribution, both capitalist and socialist.

Amory Lovins' Soft Energy Paths (1977) illustrates the essence of this critique. Associated with different energy technologies, both hard (capital-intensive, centralized, environmentally degrading) and soft (labor-intensive, decentralized, and environmentally benign), are energy paths -- the institutional frameworks and values which tend to support a certain type of technology. Lovins argues

that the values necessary for a switch to a soft energy path currently exist. What is needed, he says, is to begin substituting one type of technology for another.

The problem with this approach is that Lovins has missed the most critical aspect of this problem. In the first place, there is not much question about the existence of values which tend to support either of these technologies. The real question is, more accurately, whether or not those values which might support centralized energy systems are deemed more or less important than those which support the decentralized technologies. People had a variety of values all at the same time. But these values may often come into conflict. Values of democracy, independence and innovation may actually compete with other values more closely associated with capitalism.

More importantly, Lovins underestimates the political nature of this debate. The soft technology movement is at its core a challenge to the existing power structure. To argue that we can merely begin to substitute one technology for another ignores the fact that what we face is actually a political battle. The change to soft technology calls for a radical transformation of the means and the relations of production in the industrialized world since the bureaucratic organization of production rests upon centralized control of the means of production, including the production of energy. This control is legitimated through the existing relations of production as well as through appeals

to values rooted in the basic fabric of society. It is perpetuated through the legal system, the media, the educational system and other supporting institutions. This control facilitates the extension of property rights to include the determination of acceptable limits of additions and withdrawals.

Lovins, however, seems to be assuming one of two things: either politicians will begin to make policies which will facilitate the development of soft energy technologies and lead to increased rates of adoption, or as the grass roots adoption of soft technologies proceeds, the market will begin to grow leading to increased power and influence for the manufacturers of decentralized systems who will then force the political system to respond with additional incentives.

The issue here is whether we are going to continue to base policies on the assumption that markets operate to meet values expressed in terms of price or whether we are going to develop a more comprehensive view of behavior. While these models offer a certain rigor and elegance while their postulates hold, they inevitably fail to explain the complexity of human interaction and decision processes. Moreover, they almost insure that the needed alternatives will not be fully developed until "rational" decision makers perceive a greater potential for profit from these alternatives than from charging much higher prices for an increasingly scarce commodity.

What we need is a theoretical framework broad enough to include a wide variety of variables pertinent to adoption yet specific enough to allow us to make some fundamental determination of the needs for future energy policy. We must be aware a) of the subjective nature of the decision to adopt any alternative, including people's expectations, values, and emotional and rational motivations; b) of the fact that these subjective variables are constrained by the institutional framework; and c) that individuals who are in positions of power will frequently use their ability to control rewards and sanctions to both encourage the adoption of those alternatives which least threaten their position and to perpetuate a value system which supports the existing institutional framework.

Synopsis

As we can see from this brief history, production in industrial society is inextricably tied to forms of energy use. The environmental movement has increasingly realized the importance of the way in which we use energy not only for quality of life considerations but also for the impacts which different forms of energy have on the environment.

The solutions to this problem are inherently political. The focus of this political struggle has been primarily on the most obvious, most degrading forms of energy systems -- nuclear, coal, and oil -- through attempts to stop

the building of new plants or to install pollution control devices on older plants. But these are only stop-gap measures. In the meantime, the attempts to advance alternatives have been stifled because so many people concentrate on the need to find substitutes for the large, centralized fossil fuel plants rather then finding ways to reduce the need for those fuels in the first place. The individual homeowners who end up using this fuel have been ignored because the turn-over in new homes is so slow that they seem to offer little hope over the short-term.

On the other hand, there are many alternatives that can be incorporated into either new or old homes. Such alternatives reduce our need for centralized production of energy and thus would make alternatives like co-generation more viable. This dissertation will focus on the way in which people's purchases of alternative, decentralized energy systems (active or passive solar designs, wood stoves, windmills, etc.) is influenced by their attitudes, values, and demographic characteristics. In addition, we will examine some the role of price factors, information, habit and other market-oriented variables to determine the relative impact of markets on the adoption process.

In order to begin to understand what variables might affect people's decisions, we will next, in Chapter 2, look at the variety of explanations of consumer behavior in markets. Following this, Chapter 3 examines the sociological and social-psychological literature to determine what

types of considerations would be appropriate to include in our model. In Chapter 4 we will explore the findings of numerous studies on the use of energy.

Chapters 5, 6 and 7 are the methodology chapters. Chapter 5 will lay out the research design of this dissertation. To gather data on consumer behavior, a survey of homeowners was conducted in the state of New Hampshire. Chapter 6 will begin to explore the data for any basic differences between those people who choose to install energy alternatives and those who opt for more traditional systems. In Chapter 7 we will develop logit models which will allow to see which variables in this study help us to understand the difference between adopters and non-adopters. Finally, Chapter 8 will make some conclusions about the viability of the general model presented in this dissertation versus the traditional models of behavior explored in Chapters 2 and 3. We will also show how this study enriches our understanding of this form of behavior over the studies examined in Chapter 4.

CHAPTER 2

THE ECONOMIC APPROACH TO ADOPTION

Introduction

Despite the important role which energy plays as a facilitator of social action and interaction processes, sociologists have traditionally paid it scant attention (Klausner, 1978). While this changed following the second oil price increase of 1979-80, most research efforts have been relegated to a diverse group of social scientists, engineers, physicists, and economists conducting largely uncoordinated research. The result has been a haphazard approach to the study of energy decisions which has been theoretically limited and, at times, unsophisticated. The problems which we face are not just technological or even, in the final analysis, economic. They are essentially social and political problems. Thus it would seem that sociology, and systems theory in particular, can potentially provide a more focused approach to the study of energy decisions. It should help us to understand the complex interactions of people making decisions in on-going social situations.

The purpose of this chapter is twofold. First of all, we shall examine three theories which attempt to explain consumer behavior and some of the problems with those ap-

proaches. Since the adoption of home energy systems is essentially a form of consumer behavior, these should give us a great deal of insight. Secondly, we shall look more closely at the sociological literature to see what types of variables we might look for to more fully explain behaviors which take place within social systems.

Markets

Exchange in markets is generally seen as a "more effective" mechanism for allocating goods and services to meet people's needs than the central planning that occurs in non-market economies. Without markets, someone must decide the complex issues involved in any economy: what should be produced, how resources should be allocated by the society, what price should be charged for various goods, etc. In a market these decisions are all made by individuals acting to further their own interests (Lindblom, 1977).

Since individuals freely enter into these exchanges, they pay prices for goods that reflect their value tradeoffs, their interests. In economic terms, the prices that accurately reflect people's interests are efficiency prices. They reflect an individual's appraisals of the marginal utilities of goods. While in theory efficiency prices can be established by either markets or by authority systems (bureaucracies), this is much more easily ac-

complished by markets. The price must inform both buyers and sellers of the costs at which goods and services can be provided. Prices which do not accurately reflect the costs -- i.e. the alternatives foregone -- are known as arbitrary prices. Such prices may deter, but not necessarily prevent, producers from becoming involved in exchange.

It is possible to extrapolate from these individual exchanges to an ideal situation. If you imagine that in free exchanges each individual (both buyer and seller) enters into exchange only because it is advantageous, then both individuals increase their satisfaction levels. Under appropriate conditions, a situation can be reached in which all mutually advantageous exchanges -- and only those exchanges -- are conducted. Such a situation is referred to as a Pareto optimum.

Given such an optimal situation, it is easy to see why markets are much more desirable than authority systems for increasing satisfaction levels in any society. The problem of course, is that we are seldom given such a situation. A variety of conditions make it impossible to attain optimality.

In order for such a condition to be attained, people must be free to enter into exchanges, there must be a large number of producers with no few so large that they can control market activities, these producers must be manufacturing homogeneous products, and both buyers and sellers must have complete knowledge of market activities.

In the real world there are many divergences from these prerequisites. If we look at markets as existing in 3 areas -- labor, consumption, and production -- we realize that the extensive inequalities that have developed between producers and consumers, between producers, and among consumers prevent markets from reaching a Pareto optimum. For example, laborers are not always free to enter into exchange relations with producers. In many situations, given the relative lack of alternatives they must sell their labor at a price determined by the producer. Furthermore, negotiations are not carried on constantly since this would be too costly.

Perhaps more important for our analysis, the variety of options open to consumers is limited through a host of processes. There may be little competition between producers as a result of monopoly or, in less extreme cases, the domination of markets by a few producers. Furthermore, it is literally impossible for consumers today to be aware of the variety of market activities, including cost and quality of goods marketed or purchased.

The externalities associated with production also imply uncounted costs. The uncounted costs lead to arbitrary, not efficiency prices. Market systems are not able to deal with these problems. (Of course, authority systems have historically ignored such problems).

In addition, production decisions are often influenced by investment in research and development, taxing policies,

and import/export quotas and tariffs, all of which are the product of political decisions and are thus outside the realm of market forces. They can alter market activities, investment in production, etc. (The extent to which these political decisions are democratic is an entirely different matter.)

Finally, optimality may not be attained because of consumer incompetence. Consumers are seen as being rationally motivated because to gain something they must give up something else. This leads us to a consideration of the basic theories of consumer motivation. To fully understand the behavior of markets we must move back and forth between macro level and micro level theories. In the next section, we begin to examine why individuals behave the way that they do in economic realms.

Models of Consumer Behavior

There are three fundamental ways to explain consumer behavior. The first of these views the consumer as sovereign, as independently making decisions based on his or her values, and as being the driving force of production. The second, which we shall call here the manipulated consumer, sees the consumer as subject to the influence of advertising and other corporate activities. The final view, that of structured consumption, sees consumer behavior as being a reaction to the alternatives that are made

available by a particular form of production. Certainly these are ideal types. Reality probably lies somewhere in between these different points of view. But before we try to develop a synthesis it is probably best to examine each of these in turn.

Consumer sovereignty. The basic assumption of neoclassical economic theory is that consumers, under budget constraints, act rationally to maximize the subjective utility associated with their behavior. People's economic choices are motivated by a desire to gain something. But the individual must act rationally because in order to gain something of value one must give up something else. Scitovsky points out that unless one is rich, it is impossible to fully satisfy all of your needs. The consumer must see to it that "any extra dollar [spent] on one thing yields as much satisfaction as if [spent] on another. If this were not so, a little rearrangement of spending patterns could yield more satisfaction at no cost" (1976:4) Not only is this the "cornerstone of economic theory and a faithful description of rational choice...[it is] the basis for our expectation that market prices correctly reflect what consumers want..." (1976:10). Supply and demand schedules are the statistical outcomes of these aggregated decisions. Production levels in market soc-ieties should theoretically be geared to these schedules.

In this perspective, purchases will not be made by

consumers unless those purchases satisfy some basic need. Needs, in turn, are regarded as always existing. Sales in the market occur because the demand for a product, rooted in these basic needs, exists or is at least latently awaiting activation.

This approach to decision making has been formalized in Subjective Expected Utility Theory (SEU). According to Simons (1981) there are a number of assumptions which underlie this theory. SEU assumes that decision makers have a well defined set of alternatives from which to choose, that they have a well defined utility function (i.e., that they can hierarchically rank all of their wants or needs and assign to each a specific valuation), that they can assign a joint probability distribution to all future sets of events, and that the decision maker will select the alternative which will maximize the expected outcome in terms of the utility function.

Information about consumers can be inferred: a) if we assume that consumers make choices in order to maximize a utility function, and b) if we can assume a form for that function (Dinan, 1987). The specific form of that utility function will be affected by the discount rate -- the willingness of a consumer to invest in, e.g., energy conservation technologies. The discount rate reveals the rate of return which a consumer feels is necessary in order to undertake an investment in conservation (Dinan, 1987). A lower rate indicates a willingness to invest. We shall

return to this issue later.

There are a number of criticisms leveled at this approach. First, as Dinan (1987) points out, consumers do not necessarily make choices in a manner consistent with the theory -- i.e., they do not necessarily compare all alternatives based simply on the expected utility. They may, instead, come to their decisions by comparing goods one dimension at a time rather than by comparing the entire unit.

Goods should be seen as bundles of properties or characteristics. As Lancaster (1979) argues, consumers are only interested in goods because they possess properties or characteristics which the consumer finds desirable. It used to be assumed that the utility of a good was a simple product of the addition of all of the characteristics of the good. But you can only assume linearity and additivity of traits when goods are divisible -- i.e., when they can be consumed in any quantity. Additivity assumptions are inappropriate when goods can only be consumed in fixed sizes; when they are indivisible.

This presents certain problems for this approach since a recognition of this difference makes decision more difficult. For divisible goods, consumers only need to know the quantity of characteristics per unit. However, for indivisible goods, consumers need to know the ratio of characteristics (Lancaster, 1979). This assumes a complicated calculus on the part of the consumer.

When the consumer subjectively decides that all of the available alternatives offer different, and valued, characteristics, then he or she will probably select only a subset of all the possible traits for comparison. If the total number of options is too large, the consumer may overreact and attempt to minimize the number of traits to be considered and select the first alternative which meets some minimum standard. The degree of active reasoning involved, or the extent of the search for information, will thus be subject in part to the amount of product differentiation.

A second factor leading to what market researchers refer to as extended problem solving is the salience of the purchase; the degree to which the purchase reflects on one's self image or the amount of social pressure, both of which may raise the amount of involvement in the decision process. Finally, extended problem solving necessitates sufficient time to seek out information. Of course, all of these factors -- involvement, differentiation, and time pressure -- are present to greater or lesser degrees. Thus, decision making which is a product of these factors runs the gamut from a total lack of active reasoning (for routing decision making) to extended problem solving.

Individuals are also likely to seek out information if there is a perceived risk involved. More contemporary elaboration of SEU theory recognizes that people make decisions under conditions of uncertainty. Risk will be higher

if: there is a high price; the length of the commitment (such as a house purchase) is long; the purchase is conspicuous -- i.e., it is more visible or there is social pressure to make the right decision; there are greater potential harmful effects; or the decision will have impacts on subsequent decisions.

Other conditions affect the desire to seek out information. If information appears to be readily available, consumers are more likely to attempt to incorporate it into their decision. Finally, a person's confidence in his or her decision making ability has an impact. If a consumer is confident that he or she can judge or evaluate brands, then they are more likely to seek out information.

Market research points out that all of this is mediated by personality characteristics, family roles, and demographic variables. Personality traits would include open-mindedness, cognitive capacity, or the confidence in one's ability to control the environment. Family role structures would incorporate such variables as one's concern for the welfare of a spouse or children or sex (women search more for durable goods than men). Demographic characteristics include age, permanence or transience, etc.

At some point the marginal utility of additional increments of information is reduced. The added costs of accumulating more data will add little to the reduction of risk. Therefore, it is no longer rational to seek out information. Alternatively, information overload may inhibit

buying by leading the consumer to disregard pertinent information.

While these considerations make SEU a more complicated, more elaborate approach, there are still numerous problems. In the first place, these models assume that price always measures both scarcity and value, but price cannot distinguish between "natural" effects on supply (or demand) and those that arise from policy. In other words, price may reflect a relationship between supply and demand, but it does not take into consideration the fact that either of these may reflect a variety of government policies rather than any absolute resource depletions. This does not pose a problem for markets, but it raises important issues with regard to the development of energy substitutes, since it is entirely possible for policy decisions to keep price at a lower level than it might otherwise be, given the real levels of scarcity.

In addition, differential funding for research and development, primarily the result of political decisions, affects the ability of different market sectors to compete with each other. Many of the externalities associated with production, especially with regard to centralized energy systems, are not recognized by the market. We also cannot rely on the market to allocate goods in socially optimal fashion.

This approach also assumes that on the macro level all of the information which people need is available. There

is an additional assumption that all values can be expressed in terms of price. Values which cannot be expressed in such a manner are irrational and pose a threat to the market.

Simons elaborates upon the fundamental weakness of this model. Can we assume, as SEU does, that a decision maker, in one comprehensive view, can contemplate the consequences of a wide variety of alternatives over all possible future states of affairs and that he or she can assign a preference to all of these possible outcomes? Is it logical to assume that a decision maker has reconciled or balanced all conflicting values and incorporated them into a utility function? Can we also assume that all values can be expressed in terms of price? Furthermore, should we simply finesse, as SEU does, the origins of values as well as the way in which information, upon which people rely to develop their preferences, is disseminated?

In summary, the consumer is seen as having an ordered structure of preferences, and she enters into market relations with the intent of maximizing outcomes. But can we argue that this takes place <u>independently</u> of investment decisions made by producers? Do prices reflect merely the values of consumers or are many price factors outside the realm of consumer activity? For example, to what extent are purchases made by producers subject to the constraints of consumers? Certainly such activity affects price, but at the very least it is subject to market forces other than

consumer values as reflected in their purchase. The next sections begin to address the more relevant questions of how much sovereignty exists and to what degree preferences are structured.

Manipulated consumption. Market researchers argue that consumer influence and persuasion is a socially legitimate activity because the consumer sets the agenda for the entire process and is ultimately free to make his or her own choices. For example, one text argues:

> "...a purchase will never be made unless underlying needs (or motives) are activated. Buying action is stimulated only when an alternative is viewed positively in terms of need satisfaction. The marketer cannot create the basic need." (Engel, et al., 1986: 53)

On the other hand, Lindblom (1977) argues that activities in markets have become increasingly susceptible to the decisions of bureaucracies. Admittedly there is a circularity in markets that is difficult to deny. Consumers are not buying things that they do not want. Similarly, producers cannot produce goods without some consideration for what people desire. At the same time, producers cannot be subject to the vageuries of consumer whims. To a certain extent, they must try to convince consumers that their pro-

duct is somehow more desirable than others. Frequently, though, advertising has a more pervasive, more insidious, role.

Advertising can be seen as playing a dual role. The first is to give consumers information to persuade them to purchase one product over another. In this way, advertising is filling a role that is absolutely essential for markets to operate. Of course, the accuracy of this information is often questionable. Misleading of consumers through practices of omission is frequent, especially given the complexity of modern industrial societies.

The second role of advertising, however, may be to create a need where none exists. The proliferation of trivial goods reflects this tendency. Of course, such persuasion has limited success. The fact that 80% of new products fail demonstrates that consumer wants are finite.

But the net effect of advertising is the creation of a consumer culture (Ewen, 1976). Rosenberg (1976) argues that there has been "a radical transformation of attitudes towards consumption and savings". This is reflected in the recent explosion of consumer debt and the low percentage of savings in the United States.

According to Lancaster (1979), it is generally assumed that the variations in taste and preferences are real and are important because consumers believe themselves to be better off when they have a product which fits exactly their ideal means of meeting a need. Problems arise when three

conditions are present: when there is variety in preferences, when there is potential variety (depending on technology), and when there are economies of scale of production. Problems occur because a change which brings efficiency, in the form of lower prices for the consumer, by reducing variety introduces problems of equity by making some people better off while making others worse off.

Scitovsky's (1976) lucid analysis of the consumer culture explores the psychological dimensions of this phenomenon. He says that since economists see people as the final arbiter of their own fates, they have ruled out as a logical possibility any conflict between what a people choose to get and what will satisfy them. Economists believe that: 1) consumers are free to follow their own tastes, independent of others, and 2) that the market can accommodate consumer tastes all of the time.

The first statement, he says, ignores the fact that tastes can be influenced by "example, custom, suggestions, consistently change by...experience, modified by changing prices and the availability of some satisfactions and the unavailability of others" (1976:5). Moreover, even our ability to derive satisfaction may be culturally influenced.

Regarding the second point, he views the market as a voting machine, a plutocracy, where the rich rule by virtue of having more votes. But this is offset by the economies of scale evident in modern industrial societies -- a sort of mob rule where the mob is able to get what it agrees it

wants. Certainly advertising acts to promote this agreement. But individuals also find their tastes well catered to if they are "conformist enough to share them with millions of others" (1976:10).

The problem, he says, is that people have competing needs. He consolidates the motivational forces identified by some behavioral psychologists -- relief of discomfort, stimulation to relieve boredom, and the pleasures that can accompany and reinforce both -- into two areas: want satisfaction (relief of pain) and pleasure. Economists do not distinguish between the two in their central concept of consumer satisfaction. Satisfaction is simply inferred from purchases. The problem is that the net effect of mass production is the reduction of novelty leading to a reduced ability on the part of consumers to meet their real needs for stimulation. Furthermore, advertising, in conjunction with education and other socializing agents, convinces people that what they want is comfort. Since products which increase comfort are also what are most available, then what appears to be positive, comfort-seeking behavior may be a simple response to the types of products made available through mass production.

Scitovsky extrapolates from this to a critique of our economic measures of well being. Stimulus-related products typically provide satisfaction to more than just the consumer. Comforts, on the other hand, do not usually carry as many external benefits and frequently generate negative ex-

ternalities through greater reliance on industrial technology. Thus, the consumption of a comfort product as opposed to a stimulus product, if they are priced the same, may provide the same amount of satisfaction to the consumer but they do not necessarily provide the same total satisfaction to the society. Therefore, statements that a rising GNP demonstrates a net gain in satisfaction is a logical leap that requires that we assume a Pareto optimum (and the associated prerequisites: competition, a free flow of information, free entry into exchanges, etc.). In addition, many of the indicators of satisfaction (self-sufficiency, work satisfaction, etc.) are non-economic and unmeasured. Values other than those measured in the market are considered to be of less significance (Cottrell, 1955).

In a somewhat analogous criticism, Lasch (1978) argues that many patterns of consumption are a product of narcissism in contemporary society. Narcissism, in the Freudian sense in which Lasch employs the term, implies not self-love but self-hate. To satisfy feelings of worthlessness, people consume more, identify with famous figures, etc. Since his analysis traces these feelings of lack of self-worth to the fact that individuals have ceded control over their lives to bureaucracies, it nevertheless points out that consumption is affected by cultural considerations.

This, then, leads us back to the basic point. To what extent are consumers sovereign actors in markets? Scitovsky says that they are free to choose from among a basket of

goods but that they are not able to choose what those goods will be. Similarly, Schnaiberg (1980) argues that we cannot see the behavior of consumers as autonomous from the discretionary investment and production decisions of industrial bureaucracies.

Furthermore, besides the direct manipulation of consumers through production decisions in conjunction with advertising and the creation of a consumer economy, there are other factors which structure consumption for groups of consumers. Ewen (1976) points out (in keeping with the Weberian view of power) that consumption is a major factor in class stratification in contemporary society. While this adds credence to Scitovsky's argument -- since mass production is designed to give the masses the products of the wealthy which they so covet -- it also leads to our final view of consumer behavior.

Structured consumption. The radical view goes beyond an analysis of either consumer or producer sovereignty to examine the structural factors which constrain both the market and the consumption capabilities of individuals. According to Gintis this view incorporates two assumptions:

> "the choice set of socially feasible options in the areas of work, technology, and public policy...is constrained to those compatible with the reproduction of the social relations of capi-

> talist production [and]...observed consumer behavior in capitalist society is a rational reaction to the structure of available alternatives for social activity open to the individual." (1972: 267)

Let us focus for a moment on one major constraint on consumer action, that of income. Scitovsky's view would be that wealthier consumers tend to exercise a disproportionate influence on patterns of production since they are product innovators and they shape the consumer aspirations of the other classes. The radical view, however, would hold that since the income of the masses is wage income, it is determined by the class relations of production, something well outside of the realm of consumer sovereignty (Schnaiberg, 1980). This theory holds that "the basic spheres of social activity...are <u>alienated</u> in the sense that their historical development does not reflect even the <u>manifest</u> preferences of individuals affected by their operation" (Gintis, 1972:210).

In the neo-classical tradition, exchange values are primarily determined by use values (given certain constraints of resources and technology). According to this approach, since exchange values influence the process of investment and the resultant production capacity, they become "essential determinants of use values" (Gintis, 1972: 275).

Gintis goes on to describe the two mechanisms which he

sees as bringing capacity development into line with the prerequisites of capitalist reproduction: associative and cybernetic patterning. Both of these operate through the structure of available alternatives. The first refers to the fact that people derive satisfaction from those things to which they are consistently exposed. Individuals also "prefer" those goods and services which are highly available (and thus have a low exchange value).

But, Gintis continues, individuals are also goal oriented creatures. They are capable of "conscious programs of self-development", by which he means activities of an educational nature. These activities, however, are limited both by the costs of acquiring skills or knowledge as well as by the "expected future structure of availabilities". Thus, once again, people's preferences are shaped by the relative availability of goods.

While this cybernetic patterning is a crucial concept, Gintis's approach seems too limited. The argument which he makes fall short of a traditional Marxist approach. While individuals are creatures of habit and goal-oriented, they are also creative. A cybernetic approach must imply not only that individuals regulate behavior to accomplish normatively prescribed goals, but that they can also <u>set</u> goals. While the social situation may set the objective conditions under which decisions are made, we must also be aware that subjective interpretations also have importance.

This has not been the concern of traditional, "offi-

cial", Marxist analysis. Traditionally it has been assumed that objective conditions determine consciousness, and there has been a dismissal of the concern over false consciousness. True class consciousness would inevitably arise out of objective structural conditions. The early Frankfurt school, however, called this assumption into question. The rise of the interventionist state, the increased rationalization of social institutions, and the reification of consciousness would all hinder the development of class consciousness. For our purposes, this points to a need to examine more fully the ways that subjective interpretation of situations can be affected by social institutions and culture. To an extent, this is the strength of the adoption of innovations framework.

The Adoption of Innovations

The focus of the adoption-of-innovations research has centered primarily on: a) the psychological characteristics of people who adopt at different stages (Rogers, 1962; 1983); b) where adopters get their information, i.e., the relative impact of the media, of models, or of personal communications at different stages of the adoption process (Rogers, 1962; 1976; Singh and Pareek, 1965); and, more recently, c) the impact of values (e.g., profit motivation versus environmental concern) on adoption (Pampel and Van Es, 1977).

In all of these analyses, the theoretical perspective of Rogers and his associates forms the basic approach. Rogers regards adoption as goal-oriented behavior, which involves effort, and which takes place in situations that are normatively regulated. Adoption also has four key elements: an innovation, communication, in a system, over time. The adoption process is also a mental process. While cultural norms may constrain innovativeness, all adoption still involves a decision-making process in which individuals must observe and analyze behavior, decide on a course of action, take it and then analyze the consequences.

This process is broken down into a number of stages. The first stage of this process involves awareness. Following the development of interest in an innovation, people will seek out information. They will then evaluate the information to determine whether the advantages outweigh the disadvantages. The trial stage follows the evaluation of the innovation and, if it is successful, frequently results in adoption.

Rogers sees awareness as a fairly passive stage of the adoption process. It is frequently the result of an accident. This is more likely to be true of innovations of farm technology than it is of the adoption of technologies designed to avert scarcity. In the latter cases, it would seem that emotions are important arousers of interest.

While impersonal information is important at the

awareness stage, personal communication, involving two-way exchanges, are more important at the evaluation stage. Such personal communications are to influence behavior as well as ideas. They seem to be more important in overcoming apathy or outright resistance. There is also, according to these studies, little evidence that lack of knowledge affects adoption. Rather, selective exposure (resulting from past experiences, values and psychological characteristics) has an effect upon the relationship between awareness and adoption. Innovators, for example, have more favorable attitudes toward new ideas.

A variety of other factors also influence the adoption of innovations. The perception of some advantage relative to other types of technology is very important. Relative advantage includes more that just initial cost. It should also include the length of the payback period, tax incentives which may alter cost considerations, etc. Adoption is also affected by a number of other factors: the degree of compatibility with the adopters' values, the complexity of the technology (how difficult it is to understand and use), and the amount of risk (economic, physical, mechanical, or social-psychological uncertainties) perceived as being associated with the innovation. The extent to which an innovation may be tried on a limited basis (divisibility) or the extent to which the results can be disseminated easily (communicability) also effect the rate of adoption (Rogers, 1972; Shama, 1981).

While the perception of advantage is important, relative advantage may also be emphasized by crisis. In addition, the perceived seriousness of the need can also be an indicator of advantage.

Rogers sees this process as proceeding from the top down. The first innovators are truly venturesome individuals, but the early adopters who come after them are the opinion leaders in the community. Coming from higher socio-economic backgrounds, they frequently adopt innovations in an attempt to increase their status in the community. Rogers envisions a two-step flow of communication. These early adopters are influenced by change agents (professionals who act as communication links) and then in turn these opinion leaders influence the rest of the community. Following these early adopters, the early majority adopters tend to adopt in a very deliberate manner, seeking out as much information as they can find and going through a very elaborate decision process. The late majority adopters are individuals who were at first very skeptical and wait to see how well others do with the innovation. Finally, there are the laggards, people with very traditional orientations who are extremely hesitant to try something new.

As successful as this framework has been in explaining the adoption of innovations, it still has its drawbacks and its critics, especially with reference to solar energy innovation. Shama (1981) points out that while the diffusion

theorists see solar innovations as simply another service which is provided to consumers, social change theorists feel that it is an expression of changing American values. The latter argue that Americans, in the face of increasing inability to meet material needs, are opting for a simpler lifestyle. Shama argues, though, that the diffusion literature provides a valuable framework for policy makers and that early research can facilitate the adoption process.

Foster (1973) enumerates the variety of cultural and social barriers which might impede the diffusion of innovations. Traditionalism, ethnicity, pride, modesty, religion, etc., may all hinder adoption. Social barriers like group solidarity, public opinion, factionalism, vested interests, or competing loci of authority (family, political structure, etc.) may retard diffusion. Finally, caste, class, political structure or other social structural characteristics may hinder the spread of innovations. But seldom are these characteristics specifically addressed in the adoption of energy technologies.

Rogers also takes into consideration a number of methodological and theoretical weaknesses found in adoption studies, pointing out why they have developed and providing some solutions. The first of these is the fact that research on innovations tends to have a pro-innovation bias. Most research assumes that the innovation <u>should</u> be diffused. For a number of reasons, a bias of this type is understandable: historically we have studied those innova-

tions which were profitable; the act of innovation is laden with positive values; the research has often been funded by change agents; and successful diffusions can be studied retroactively (Rogers, 1983).

However, this bias limits the range of studies that are undertaken. We frequently ignore the study of ignorance of innovations, underemphasize the rejection of innovations, overlook reinvention, and ignore the anti-diffusion programs that often develop to prevent the spread of bad diffusions. As a result, we know more about: a) rapidly diffusing innovations than about slowly diffusing innovations; b) adoption than rejection; and c) continuance rather than discontinuance (Rogers, 1983).

To solve this problem, it is necessary that we conduct studies at more than one point in time. This would allow us to learn more about the long-term consequences of any innovation. Secondly, we must exercise caution in selecting innovations and do more comparative studies; we must look, e.g., at other innovations that have failed in the same context as the one that succeeds. Next, we must be careful not to assume that an innovation is right for everyone all of the time. For some people, rejection may be a rational decision. We must be cued in to the particular needs and problems of individuals that are peculiar to their situation. Fourth, we must examine the broader context of innovation: how decisions that something should be diffused are made; how policies affect diffusion; how in-

novations are related; and how it was decided to conduct the research and development. Finally, we must also increase our understanding of motivations for adoption or non-adoption (Rogers, 1983).

The second major criticism of diffusion research pointed out by Rogers is the bias toward blaming individuals when diffusion proceeds slowly. The tendency, critics point out, is to side with the agency promoting the innovation. To an extent, this is evident in the types of variables that are employed. While some may look for system failure -- e.g., the amount of contact between change agents and adopters -- the majority of variables -- education, income, mass media exposure, etc. -- are designed to measure the success or failure of the individuals within the system, not the system itself. This is also evident in the fact that blame is often placed on "laggards" or "late adopters", people who are seen as irrational, dogmatic, resistant to change. The problem may as readily be seen as a system problem -- e.g., a self-fulfilling prophecy created by the failure of change agents to contact potential laggards.

Again, there are a variety of reasons for this problem. To a degree, the individual blame bias is picked up by researchers from change agents. On the other hand, researchers may feel that there is nothing they can do to change the system, so why not focus attention on the individual. Individuals are more accessible and, if the indi-

vidual is the unit of response (to an innovation), then perhaps they should be the unit of analysis.

Solutions to this problem primarily involve caution in setting up your research design. Keep an open mind about the causes of success or failure. Be sure that all participants are involved, including potential adopters. Finally, more structural variables should be included. Who owns and controls the research and development industry? Who controls communication systems? Such inquiries will vastly broaden our understanding of the success or failure of the diffusion process (or the evaluation of an innovation).

Rogers also deals briefly with a few other problems evident in the literature. Studies primarily rely on recall data. Such information will vary with the innovations salience, with the length of time that elapses between the adoption and the study, and with individual differences such as education, memory, etc. To compensate, researchers should rely more upon field experiments, longitudinal panel studies, archival records, and case studies.

Another weakness is the fact that many studies fail to show how the socioeconomic benefits of diffusion are distributed. Very often, new innovations widen the gap between groups in the society.

Finally, many studies have been conducted in the developing countries, but the assumption is usually made that the process of diffusion will still be the same as in the industrialized countries; that it will follow the same S-

shaped curve despite the lower education, income, etc. of the citizens of Third World nations. Studies also assume that nations must pass through the same process of development as the industrialized nations. The dominant paradigm of western development has maintained that economic growth takes place through industrialization and urbanization with capital-intensive, labor-saving technologies and centralized planning. Accordingly, problems of development lie with the developing nations rather than with the system. Researchers must attempt to understand the socio-cultural systems within which adoption takes place.

This leads us to a consideration of the apolitical nature of this approach. On the one hand, it tends to not take into consideration the conflicting norms in any society. On the other, it fails to see that policy may reflect these conflicts of interest. This is partly a product of its failure to take social structural conditions directly into account. For example, norms are deemed important (since they constrain innovators and influence the evaluation stage of the adoption process) but they are not usually explicitly included in the analysis.

Lauer (1977) expands on this by pointing to the fact that adoption may be hindered not only by social barriers but also by conflicts of interest. He says it is not enough to simply argue that increases in communication may create confusion. Rather,

"we need to take more account of conflict and

> contradiction within social systems. A system does not simply have norms that favor innovation or norms that favor the status quo; systems may contain diverse and conflicting norms because they have diverse groups with conflicting interests...we must recognize the existence of conflicting interests, so that the innovation which will be advantageous to some will be disadvantageous to others." (1977: 173-174)

Finally, this framework fails to apply directly to the adoption of energy technologies. For innovations which entail a large initial investment, trialability is impossible. The only means by which people can try out an innovation is vicariously. This makes modeling (which here is used to refer to the observation of the behavior of others) and information much more important at every stage of adoption than it might be for other forms of innovation.

The following sections develop a more flexible approach to human behavior, one which falls somewhere in between the idea of manipulated consumption and structured consumption but draws heavily on the adoption of innovations framework. This synthesis will view actors as creative interpreters in established, regulated, structured social situations. First, however, we will digress briefly for a sociological explanation of how those structures arise.

Chapter 3

SOCIOLOGICAL APPROACHES TO DECISIONS

Introduction

The previous chapter explored the issue of decision-making from the perspective of market research and economics as well as through the viewpoint of the diffusion of innovations. In this chapter we will first look at the elements of sociological theory which seem to be necessary if we are to enlarge upon these previous frameworks. Following this, we will consider the micro level theory concerning attitudes and behavior from a more sociological perspective. Finally, we will present a preliminary model of the approach to be used in this dissertation.

Toward a Sociological Model of Decisions

Since the starting point of our analysis must be an on-going social system, we must first examine exactly what is meant by this term. Societies are bounded systems of interacting individuals. The action possibilities of these actors are constrained by rules and regulations. It is conceivable that there could be as many different modes of behavior as there are situations in which people interact.

That this is not the case is indicative of the fact that behaviors become, to some extent, stereotyped, or con strained, by the rules of the society. Thus, certain modes of behavior, linked to particular situations, become expected and repetitive. They become recognized by individuals as the most common patterns of behavior or standards, conformity to which may be enforced through the use of positive or negative sanctions. When these repetitive modes of behavior are found to apply to different populations over time, i.e. when they become relatively invariant and independent of the specific actors, we refer to social structure.

The most prevalent, permanent and organized of these repetitive modes of behavior are institutions. They are systems which structure or organize human action. They consist of sets of social relationships which link actors having common goals to particular issues or activities. They guide behavior through the development of a division of labor, patterns of decision making, and the distribution of resources -- along with the associated rights and privileges -- among actors (Baumgartner, et al., 1977).

The development of a given order is the result of a variety of macro-level structuring factors. These include the material conditions of the society (geography and technology) as well as the cultural and ideational conditions, which influence the types of activities which are acceptable and the rewards or outcomes of action. These may be

seen as simply inherent in the system or as the result of the deliberate planning and action of individuals. Human action and its indirect consequences may lead to the restructuring of the society.

The control of resources is crucial to this last factor. Unequal control over resources may grant individuals or groups a disproportionate ability to structure their environment. This control may result from a variety of factors: environmental considerations may make crucial resources more available to one group than to another, natural capabilities may be unevenly distributed, the normative structuring of the system may grant structuring capability to some actors to assure the efficient functioning of the system, or conflict may result in the achievement of unequal control by one group.

In any event, this initial difference in resource control is cumulative, i.e. it offers further opportunity for additional control. The inequality allows some actors the ability to take advantage of new opportunities, to prevent or control attempts by other actors to gain control, and to generally structure themselves and their surrounding environment in such a way that they can facilitate the attainment of their goals.

This power amplification may be especially effective when these initial differences can be turned into meta-power. This concept refers to the ability of individuals to manipulate or change the matrix of behavioral expecta-

tions -- the "rules of the game" -- as well as the distribution of resources, rewards, and the overall cultural orientation. This is not the same as power. The Weberian sense of power refers to the ability of actors to influence actors within a given institutional framework. Meta-power is the ability to actually structure the framework within which action takes place (Baumgartner, et al. 1977).

Lukes (1974) discusses three different views of power. The first, one-dimensional power, refers to the actual exercise of power where individuals or groups are seen as having the ability to win our over others in political contests because of the resources that they bring to the situation. The two dimensional view of power goes beyond this behavioral approach by recognizing that attempts by the powerful to control decision-making are not necessarily limited to actual political contests but may be evidenced through nondecision-making, "a decision that results in suppression or thwarting of a latent or manifest challenge to the values or interests of the decision-maker" (1974:18).

The three-dimensional view sees the exercise of power as more insidious. It prevents people "from having grievances by shaping their perceptions, cognitions and preferences in such a way that they accept their role in the existing nature of things" (1974:24) thus maintaining the bias of the system. In addition, this bias is maintained "not only through a series of individually

chosen acts, but also, more importantly, by the socially structured and culturally patterned behavior of groups, and practices of institutions" (1974:22).

The ability of actors to use any initial advantage to attract other actors and resources away from the less advantaged in order to structure the institutional framework is limited by a number of factors. These might include: the extent to which there is an increasing surplus available, the legitimation of differential accumulation in inheritance rules, the development of consciousness and organization or control over resources by weaker actors, patterns of immigration or emigration, and by the availability of alternatives or the development of new and important resources.

Of course, we still need some means of understanding how this process operates on the micro level. We need to know how rewards influence behavior, how people arrive at decisions, etc. Simons (1981) argues for an alternative to SEU theory which he refers to as bounded rationality. He says that while people are certainly motivated to fill needs, they are not capable of consistently maximizing their behavioral outcomes. Bounded rationality is a means by which people with our mental capacities are able to arrive at decisions. The mechanisms of this approach include 1) some way of focusing attention, 2) a means of generating alternatives, and 3) a capability of acquiring facts and drawing information. It is to a model of this type -- a

sociological model -- that we now turn.

Symbolic Interaction and Social Learning

In order to emphasize the constructive, emergent nature of human action, Shibutani (1968) employs symbolic interaction as the basis of a cybernetic approach to motivation. In symbolic interaction, the objective reality of the external environment constrains human action, but individuals selectively perceive that environment and their reactions are creative responses to the subjectively meaningful aspects of that environment.

Mead's (1934) basic unit of analysis is the act. Individuals respond to an on-going environment by actively interpreting the situation and acting toward others on the basis of that interpretation. The first stage of the act is to be found in an impulse, a lack of effective integration with or adaptation to environmental circumstances. Sensory cues play an important part in redirecting and channeling activity. Not all cues are perceived, however. Perception is highly selective and may be a function of the impulse (Shibutani, 1968) as well as a person's values.

Mead argues that any activity or object is approached with a set of expectations, which may also affect our perceptions. The development of these expectations is, to a large extent, the result of our interaction with others and with our environment. The process of role playing and role

taking work to increase our understanding of these expectations. The process is facilitated by the use of language which allows us to anticipate the responses of others.

In Mead's analysis, there are many similarities to the social learning of Bandura (1962:1977). This might not be readily apparent since Bandura is so interested in the role of reinforcers, as were Watson and other classical behaviorists, theorists who espouse theoretical frameworks which are strongly criticized by Mead. But Bandura is not interested in reinforcers in the traditional way. In classical Stimulus- Response theory, reinforcers act "backwards" to strengthen response.

Singleman (1973) points out that the concept of self, which includes the organized responses to the expectations of others, is complementary to the concept of social reinforcers. More importantly, individuals do not have to be reinforced for their own behavior in order to learn. They may also learn from the experience of others. Rewards may act, then, to facilitate learning anticipatorily. As with Mead, attention may be shaped by values or needs. Perceived rewards do not strengthen behavior directly but serve as cues for proper behavior.

Bandura believes that learning is a more complex process than we are frequently led to believe. Due to the nature of many studies of learning, in laboratories with rats and pigeons, we have come to equate learning with response. However, it is also dependent upon an individual's imaginal

and verbal rehearsing. A model's response to cues leads to internal images which may be called upon even in the absence of rewards. Social agents are important sources of patterns of behavior. By observing the outcomes of other's actions, people may vicariously learn behavior. They develop hypotheses concerning proper behavior. But the model's behavior must be within the perceptory and motor capacity of the observer. Verbal labels act to facilitate this process (Shaw and Costanzo, 1970).

Mead also says that on the basis of our expectations, we develop hypotheses. These are tested and their validity or invalidity is established through manipulation. Hypotheses which prove to be valid will be stored in our memory (meaning). The meaning of any object is the manner in which people are predisposed to act toward it. Meanings are "stable relationships between an organism and a class of objects" (Shibutani, 1968:332). If our hypotheses prove to be invalid, meanings will be changed.

Bandura takes essentially the same approach. Motor reproduction involves the cognitive reorganization of possible responses, their initiation, monitoring and refinement on the basis of feedback. Rewarded responses, either ours or others, or their anticipation will lead to increased motivation to respond in a similar manner. Motivation to respond is likely to be higher for valued outcomes. Mead says that outcomes that prove to be especially gratifying will provide the basis of these values.

In this schema, the responses of others have an effect on our motivation to behave. But rewarded behavior, whether direct or vicarious, only motivates behavior through a process in which rewards are used as cues to anticipate foreseeable outcomes. This cognitive process, inherent in symbolic interaction and social learning theory, implicitly recognizes the importance of feedback in the development of our expectations and orientations. Our actions have certain outcomes which become inputs at later points in time. This is essential to any understanding of purposeful, goal-oriented systems. It also helps us to recognize how a diversity of behavior arises.

Mead, of course, is famous for his emphasis on the way in which social control is inherent in socialization. The meanings which we have are subject to control through the anticipated responses of others. Yet, what actions are taken varies from one culture to another as well as from one situation to another, depending upon the opportunities and the resources that are available. Shibutani says that "individuality is usually manifest only in situations where there are sanctioned alternatives" (1968: 334).

Bandura is more concerned with the development of novel forms of behavior and selection from among sanctioned alternatives. In contrast to classical S-R theory, instrumental learning should be regarded as response selection rather than response acquisition. Miller and Dollard (in Giewitz, 1969) prefer to speak in terms of response

hierarchies. Cues may be linked to several different responses. A person will respond in the way which had undergone the greatest amount of learning.

This implies an active process in which the subjective characteristics an individual possesses may serve as determinants of any response disposition. In addition, a diversity of role models may also lead to creativity and innovation. The observer acquires novel responses through cognitive integration of a variety of cues (Shaw and Costanzo, 1970).

Up to this point we have been concerned primarily with what Mead termed reflective thought or what we might call response. We must also be concerned with the non-reflective determinants of behavior. Mead sees emotions coming into play when the consummation of an act is prevented. But Mowrer (1956) emphasizes the role of learned drives such as fear. Once fear, or any other learned drive, becomes connected to a particular situation or stimulus, any response which lessens the fear will be reinforced.

Actors may simply react to these emotions or they may return to reflective thought to select from among a number of alternative routes through imaginal and verbal rehearsing. Bandura also sees modeling influences as important emotion arousers. The affective responses of a model may elicit the same responses in an observer if the latter is confronted with the same cues (Shaw and Costanzo, 1970).

This framework sensitizes us to the variety of factors

which may constrain behavior. Perception, values, expectations, and modeling all play a role in shaping responses. Price, information and other market considerations, are actually special cases of cues to which people respond. There is, however, one final area of explanation to which we should now turn.

Attitudes and Behavior

We must also be concerned with the relationship between attitudes and behavior since the grass roots movement surrounding decentralized technologies seems to rely heavily on changing attitudes in order to facilitate adoption. In this section we will briefly discuss the methodological and theoretical issues associated with studies of attitude and behavior.

There are two countervailing tendencies in the social psychology literatures. On the one hand, there is a general agreement that the correlation between attitudes and behavior is very low. But there is also a notable lack of consensus regarding the exact nature of attitudes. The two issues are most likely interrelated.

There are also two basic approaches to the concept of attitude, both of which assume that there is a large degree of consistency between responses over time. The first of these has been referred to as a probability view (DeFleur and Westie, 1963). The basis of this approach is that if

attitude responses are more or less consistent, then a large number of responses is likely to demonstrate some consistency or predictability. An attitude, then is no more than the probability of the occurrence of a certain behavior. It is simply inferred from the behaviors.

The second approach, termed latent process by DeFleur and Westie (1963), also assumes that responses are consistent but that this consistency is due to the operation of some underlying causal mechanism. According to this framework, an attitude is not just the probability of a response but, rather, a hypothetical variable intervening between stimulus and response. Attitudes mediate or constrain an actor's response to some attitude object.

If we assume that attitudes are no more than the probability of a response occurrence, then measurement is a straightforward process. However, if we assume that attitudes are actually an unobservable inner mechanism, then we are faced with much greater difficulties of measurement. Partly this is due to ambiguity regarding exactly what constitutes these inner mechanisms. Most theorists see them as having a number of components, including affective, cognitive, etc. Others argue that attitudes are unidimensional. In either case, there are serious questions about the lack of correlation between verbal attitudes and overt behavior.

To an extent, these observed inconsistencies may be due to methodological problems. Ehrlich (1969) says that

while we have standardized procedures for scale construction, etc., we have not managed to develop any standardized means of observing behavior. More importantly, we tend to measure attitudes toward a class of people, but we make our predictions about the way in which people will behave toward an individual of that class. This may be, Ehrlich argues, a special case of fallacy of ecological correlation.

Alwin (1973), says that because attitudes are not good predictors of behavior, researchers assume that attitudes are not stable, or that verbal attitudes do not measure underlying attitudes, or that attitudes do not determine behavior. In a more sophisticated statistical analysis of the problem, he argues that our difficulties are due to the fact that our bivariate models of attitude-behavior relationships are underidentified. We need to have observations of either a behavior at two points in time and an attitude at one point or a measurement of attitude at two points and behavior at one.

Sample and Warland (1973) also point out that many people who have weak or non-existent attitudes often respond as if they had a positive or negative attitude. By grouping these people with those who have strong attitudes, the observed correlations between attitude and behavior are weakened. They also imply that attempts to increase the reliability and validity of attitude measurements necessitate a greater conceptual clarity.

Whether we are concerned with the use of attitudes as predictors of behavior or simply with the nature of the relationship between attitudes and behavior, it is essential that we face some important conceptual problems. The first is the fact that not all of the components of an attitude necessarily imply a behavior. Thus, as Ehrlich says, "without a direct assessment of the 'action potential' of an attitude component, the researcher's inference about the subject's behavior, or intentions, may be phenomenologically naive" (1969:29). To deal with this, we should emphasize the measurement of the components of attitudes which do relate to behavior, such as direction and intensity. Furthermore, Ehrlich points out that the observed inconsistencies may be the result of a failure on the part of the researcher to adequately specify the criteria which will be used to determine consistency. This implies the need to rely on concrete forms of behavior and rigorous statistical inference.

Perhaps most important, however, is the growing emphasis on intervening or moderator variables (Ehrlich, 1969; Sample and Warland, 1973). These include both psychological and sociological factors: the degree to which an attitude is capable of being expressed in a behavior, the willingness of an individual to express an attitude, or the fact that the actor's perspective or definition of the act may assume consistency while the researcher infers inconsistency.

Other extremely important considerations include the degree of learning, the accessibility of behavior and the extent of the respondent's competence. Some degree of inconsistency may be due to the fact that while an actor may express a certain attitude, he or she may not know how to transfer this to action. To an extent, this may be due to "the level of direct or vicarious experience of the actor, if any, in such behavior situations" (Ehrlich, 1969:32). However, even if the subject is aware of the appropriate response, the opportunity, or the perceived opportunity, to express the behavior may not arise. Of course, even if the above situations are met, the actor may not be able to muster sufficient resources or have the skills that are necessary to perform the behavior.

Finally, we must also be aware of the compounding effect of situational factors. Many theorists (Fishbein, 1965; Fishbein and Ajzen, 1975; Triandis, 1971, 1975; Macey and Brown, 1983) feel that the influence of attitudes on behavior is mediated by structural considerations. It is to these more sociological models that we now turn.

A Sociological Model of Decision Making

For Fishbein (1965; Fishbein and Ajzen, 1975,1976; Ajzen and Fishbein, 1970,1977), attitudes refer to the evaluation of some entity: a person, a physical object, a behavior, a policy, etc. (1977). An attitude "is highly

correlated with the sum of beliefs each multiplied by its respective evaluation" (1970:467). Attitudes toward actions involve the evaluation of the potential outcomes of that action as well as the evaluation of those outcomes.

The attitude which a person holds toward an object will have an influence on the overall pattern of behavior which an individual will exhibit toward that object. On the other hand, it need not predict any particular action toward that object (1977). Rather, attitudes, in conjunction with normative beliefs, are better predictors of an individual's intent to perform an act, which may or may not be highly correlated with behavior.

Note that the attitude toward an act is also closely related to Subjective Expected Utility. The SEU of a given alternative is a product of the assumed probability that a given act will have certain consequences multiplied by the value attached to that outcome. The problem with SEU as a theory is that it encourages one to assume that it is the most important precursor, and best predictor, of behavior. Here, in contrast, it is only one of the determinants of behavior (1970).

In Figure 3.1a, we see a synthesis of the basic Fishbein-Ajzen model. The precursors of behavioral intent are both the subjective attitudes which an actor holds and the subjective internalization of norms. Attitudes are a result of a person's affective orientation toward an object and his evaluation of that action. Subjective norms are

Figure 3.1

MODELS OF ATTITUDE-BEHAVIOR RELATIONSHIPS

Figure 3.1a
Fishbein's Model

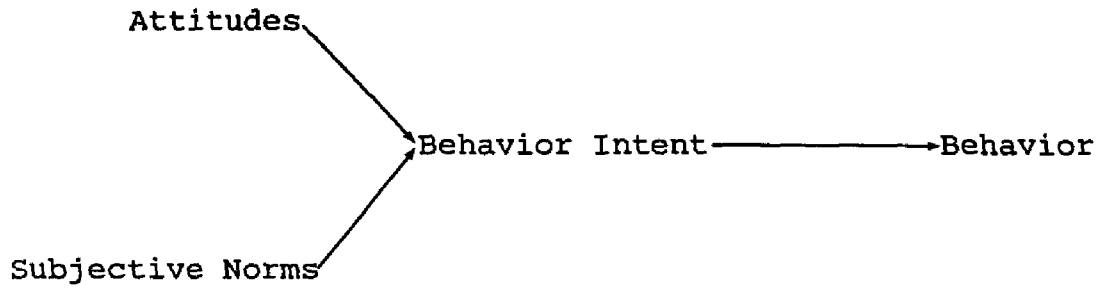


Figure 3.1b
Triandis' Model

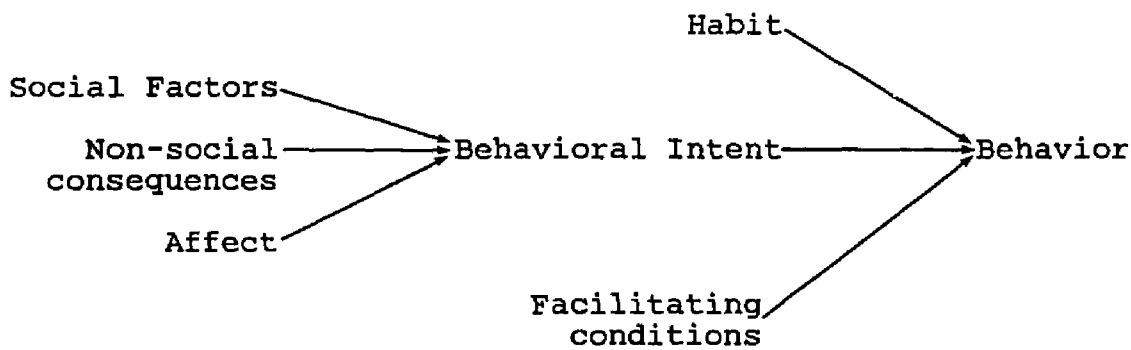
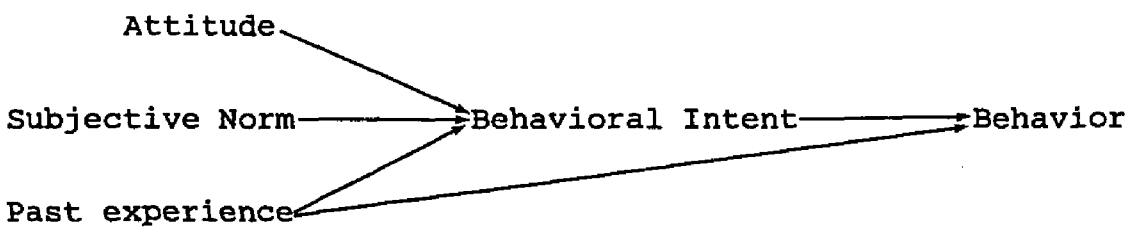


Figure 3.1c
Macey and Brown's Model



the product of the actor's subjective understanding that others wish to act in a certain way as well as his motivation to comply with those wishes. Behavioral intent is only indirectly affected by these latter considerations.

The strength of an attitude-behavior relationship will depend to a large extent on the degree of correspondence, the intuitive consistency, between the attitude and the behavior on a variety of criteria: the action, the target, the context, and the time frame. For example, if a person holds an attitude toward a behavior such as the energy crisis, there may be general attitudes about the crisis, people may have very specific attitudes about specific energy systems, and these attitudes may vary with regard to the energy systems they would like to see in their own homes or the ones they would like to see for the society as a whole, etc.

Of course, as Fishbein and Ajzen consistently point out, what they are actually attempting to measure is behavioral intent. The degree of correlation between intent and actual behavior will vary with a number of factors: the correspondence in the levels of specificity of measurement, the stability of the intention, the degree to which the behavior is under the control of the individual's wishes, and the amount of time elapsed between the measurement of the intent and the actual behavior (1976).

Triandis (1971; 1975) presents a more complicated model. He, too, argues that behavior intent is a better

indicator of action, but behavior is also a product of past experience or habit and other facilitating factors. Intent, in turn, is a function of a) social determinants like norms and roles and values which develop in relationships with others, b) the affect attached to the behavior, and c) the expectations about the outcomes of the behavior. Other facilitating variables include the ability of the person to carry out the act and the perception of cues, which are filtered through expectations, values and needs. Cues are most likely to filter through if they are able to reduce uncertainty or if the behavior permits greater predictability of the environment.

Macey and Brown (1983) attempt to incorporate aspects of both of these frameworks into a study of residential energy conservation practices (turning down a thermostat, changing the furnace filter, and exterior caulking). They propose to include past experience in Fishbein's model in order to increase its predictive capability (see figure 3.1c). They find that intention offers little predictive power over and above past experience, at least for two of the three behaviors (nighttime setback and changing filters). However, their model, which includes past experience, offered considerably more predictive power than the simpler Fishbein model.

What we need to do now is to begin to synthesize these variables into a model which will facilitate the organization of our subsuquent analysis. Figure 3.2 presents such

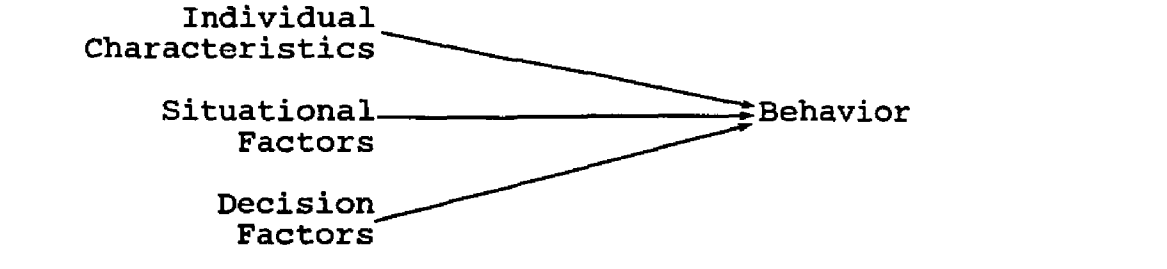
a model. Behavior is the product of individual characterstics, (e.g., attitudes, values, the subjective expected outcomes of specific behavior, and knowledge,), situational factors (general demographics), and the specific factors which people take into consideration in attempts to arrive at decisions.

Here we will argue that these latter factors include information from primary and secondary sources, subjective norms, and pricing considerations Since norms are the standards of behavior which people associate with situations, we will here assume that normative expectations are the result of the degree of exposure to behavior which an actor experiences. Habit or past experience can play a role, and the vicarious reinforcement associated with modeling behavior can affect specific decisions. In addition, knowledge about the viability of behaviors should affect the development of novel actions.

There are strong parallels, however, between this

Figure 3.2

A COMPREHENSIVE MODEL OF ADOPTION



model and the adoption of innovations framework. Subjective expected outcomes would include variables such as relative advantage and would be based upon communication (through information and modeling). Perceived complexity is one of a set of attitudes which may predispose persons to adopt an innovation. And compatibility illustrates the importance of values in the adoption of innovations. However, our model more directly sensitizes us to the importance of social norms for adoption. We also must be aware that a variety of attitudes other than just the perceived complexity of the innovation may be important. But most of all, we must be concerned with what initiates interest among adopters, i.e., what motivates them to be concerned in the first place, what cues prompt their behavior.

To test this model's explanatory capability, we should see how well each of these variables explains the adoption of innovative technologies. Before doing so, however, we should first determine how well other studies of the adoption of energy alternatives fit into this developing framework.

CHAPTER 4

LITERATURE REVIEW

Introduction

In this chapter we will survey the relevant studies on the adoption of energy technologies. First we will focus our attention on the market oriented models of adoption. While the majority of the research in the adoption literature has focused on the adoption of farm implements or similar technologies (Singh and Pareek, 1965), there has been a growing emphasis on the application of this framework to the adoption of energy-conserving technologies, much of which has a direct bearing on our attempt to understand the adoption of energy systems. However, as we shall see there are a number of drawbacks to this perspective which should be alleviated by the model developed in the previous chapter. The end of the chapter will demonstrate the way in which the model developed in this dissertation improves upon this previous work.

The Adoption of Energy Technologies

Decision Factors

Market Models and Energy Consumption. The belief that consumers will make rational decisions based on avail-

able information forms the basis of many of our most prominent studies of energy use. The reports of the Committee on Nuclear and Alternative Energy Systems (CONAES, 1978), of the Harvard Business School (Stobaugh and Yergin, 1979), and the Mellon Foundation (Sant, 1979) all tend to assume that consumers are rational utility maximizers operating in a near perfect economic system. Others (Landsberg, 1979) recognize the need to reduce structural barriers and provide incentives, but these incentives are still reduceable to price signals.

According to Barzelay and Iusem (1984), the neoclassical models of energy consumption, such as the Consumer Energy Services Module on which they base their report, assume both that consumers will attempt to strike a balance between their consumption of energy versus non-energy goods or services which is dependent on their level of income and that they will choose the energy system that is most likely to reduce the costs of energy. The model includes underlying assumptions: that consumers have perfect knowledge about fuel prices over the next 40 years; that consumers are able to accurately compare the operating and capital costs of alternatives; that consumers have all of the information about these alternatives; that consumers are able to calculate the utility-maximizing function for both the energy and non-energy services for different levels of income; and that they can select a discount rate which will allow them to compare today's foregone consumption with the

increased levels of consumption which they will be able to enjoy in the future (since investments made today can only bring returns in the future, they must be able to make utility levels comparable over time) (Barzelay and Iusem, 1984:392).

What Barzelay and Iusem do in order to compensate for what they view as extraordinary assumptions is to vary the values of different assumptions and run scenarios to test the sensitivity of the model. While this is insightful, it still does not really develop the "inner environment" that the economic behaviorists such as Simons prefer. It is still based on economic assumptions that are too seldom critically examined in the literature. These include the ideas that it is rational to conserve, that consumers will always act in a rational manner, and that the net effect of these micro-level decisions will be the increased welfare of the society.

Regarding the first point, Leik and Kolman (1978) point out that there are some situations where it is actually rational to not conserve. Specifically, in situations that involve relatively large costs and benefits, if there is a continual flow of information regarding both technological change and the introduction of new policies, and this potential information is quite likely to reduce the risks associated with decision making, then inaction is an appropriate response. They state that "if the utility of inaction equals the cost of undertaking an action, and

the costs of inaction equal the loss that occurs if a crisis arises before some appropriate response has been chosen, then...the expected utility of waiting will exceed the expected utility of action" (1978:).

In contrast to the second assumption, consumers do not always appear to act in a rational manner. According to the CONAES report, energy consumption is not strongly linked to either the level of economic activity or the standard of living. But if we are to follow rational models, we would assume that levels of energy consumption should be linked to wealth and income. The marginal utility of savings due to energy consumption should decrease consistently with increasing levels of income. In other words, the poor should be conserving more than the wealthy. For those with higher incomes, there is less incentive to conserve since energy costs are a smaller percentage of disposable income. Yet we find that in many cases, increases in income are associated with increased levels of energy conservation activity.

Furthermore, while we tend to assume some degree of elasticity in demand due to price, we find that many other factors affect decisions. Higher prices have not necessarily driven people from cars to mass transit. The ease and comfort as well as the prestige associated with the automobile have all discouraged the switch. In addition, since markets are so unstable, producers are inclined to create demand. This leads to more reliable demand.

Likewise, since continued production is essential, it is more rational to build in obsolescence. However, such attempts draw us a long way from the original ideas of an invisible hand which guides production in such a way that the society's resources are used most efficiently and there is a maximum of individual and social prosperity.

Finally, some theorists assume that as energy supplies become scarcer, the rising cost of fuel, associated with the costs of reducing pollution, will result in a steady state economy with limited growth. But when land, air and water are no longer available in sufficient quantities, markets incur severe difficulties. The theories of Locke or of Smith require unlimited abundance. The invisible hand can operate invisibly only so long as the costs associated with production do not impinge on the common good. Rational decisions on the micro level can eventually result in ecological destruction.

Market decisions are also incredibly short sighted. As Ophuls (1977) illustrates, it is unusual for an economic decision maker to consider costs and benefits that extend more than 20 years into the future. In fact, these are usually discounted to zero. Development of energy resources which will be necessary over the long term are of no economic interest to rational decision makers. Furthermore, it is actually rational for a businessman to invest little in the development of alternatives since it is in his best interest to have people be as dependent upon him

as possible. In conditions of extreme scarcity, the price that the businessman can charge is less limited. However, the market does not react well to conditions of extreme scarcity or when there is a large discrepancy between supply and demand. In these cases, there is a tendency for the market to exacerbate inequalities in the distribution of essential goods.

None of this is to argue that price is not a factor. But certainly, cost considerations must be associated with some rather compelling non-cost considerations (Gordon, 1981). Values, attitudes and information may be more important in the diffusion of solar energy than in other types of technology. For example, the major barrier to passive solar innovation is not cost, since many elements of the decision involve no cost to builders (Jackson, 1981) and monthly payments may actually be reduced when both mortgage payments and monthly energy bills are added together. Thus, solar appears to be associated with some overt values implications (Unseld and Crews, 1981).

This leads us, then, to a consideration of the sociological variables that may be factors in the adoption process. Before dealing with the role of values, norms, or other sociological concepts, let us first turn to an analysis of the general characteristics that might identify adopters.

Price. There is substantial evidence that material

incentives can play a major role in influencing behavior. Winnet (1978) has demonstrated that large monetary rebates encouraged reduced electrical consumption (by 12%), but only over the short-term. The most effective strategy seemed to be to combine rebates with feedback and a conservation strategy. Similarly, Becker (1978) reports that there is a joint effect between goal setting and feedback, with the greatest reduction in consumption occurring among those who had very difficult goals and feedback.

However, we face a different set of problems in trying to encourage the adoption of alternatives. Cunningham and Lopreato (1977) argue that price considerations are the major factor influencing energy conservation, especially among middle and lower income groups. But it is the perception of cost which influences people's willingness to buy, and this is a complicated variable to attempt to understand.

Certainly the initial cost of a lot of solar equipment is high. But pricing considerations must include more than initial cost. Long-term savings and tax breaks (credits or deductions) also influence the overall price. Boaz-Allen says that recent owners install solar for economic reasons. The Solar Energy Research Institute finds that many people feel that solar can help to save money over the long term (84%) and that solar helps to reduce monthly utility bills (82%). A similar study conducted by SERI (1980) finds that respondents feel that solar will reduce monthly energy

bills (85%) and increase the home's resale value (75%).

All of this would imply that consumers should be encouraged to purchase solar by virtue of its economic advantages. But many consumers are not motivated by long-term paybacks. They are not often motivated to invest a large sum in a product that has a payback period of 20 years. They are also discouraged by large initial costs. An investment of $40 in weather stripping and an investment of $4,000 in attic insulation may both have the same payback period, but consumers will be prompted to make the smaller investment. The large initial cost of solar frequently leads to rejection (Shama, 1981).

To overcome this problem, a variety of tax incentives have been offered over the years. However, these have not proven to be a major factor in adoption. Marsden (1980) points out that relatively few home owners have taken advantage of these credits. SERI found that these tax incentives ranked 10th among a general sample of homeowners. Even among the actual users of solar, only half felt that tax credits were important.

It is specifically because of these types of problems that Darley and Beniger (1981) feel that the unassisted operations of a free market will not result in a maximization of conservation behavior. While people may informally calculate potential savings as a function of the interaction between cost and payback periods, they react very differently to the large variations in capital cost. They argue

that one of the major barriers to adoption is the low degree of certainty that savings will be obtained coupled with the fact that the costs must be paid prior to the actual demonstration of savings.

This illustrates the need to disseminate information regarding cost considerations to the public. Consumers cannot try out the innovation for a period before adopting. Therefore, in order to reduce uncertainty they must rely on information and the observed success of other adopters. Let us turn next to these factors.

Norms, Information and Modeling. Undoubtedly one of the greatest barriers to the diffusion of energy alternatives is the lack of information regarding both costing techniques (as we saw in the last section) and system performance. Studies seem to demonstrate, however, that the problem is not that people believe solar systems to be unreliable. Rather, they simply do not have sufficient information to come to any conclusion. In a study by SERI, 1 out of 8 respondents did not know of any use of solar energy. In other studies, lack of information is usually listed as the first or second greatest hindrance.

Here we argue that the perceived acceptability of solar should have an impact on diffusion. This perception could very well be the product of exposure -- the extent to which friends and neighbors are adopting solar. If solar is perceived as an acceptable standard of behavior, or is

regarded as normative, then this should facilitate the spread of these technologies among later adopters.

The dissemination of information is strongly affected by communication patterns among individuals. Darley and Beniger (1981) argue that interpersonal networks play a strong role only for early adopters, however, and that areal diffusion (through modeling) is more important for later adopters. Similarly, Shama (1981) feels that the innovativeness is more important at the early stages, and imitation is more important later. In fact, he points out that most models of market penetration assume that adoption is a function of the number of previous adopters.

Lowe and Moryadas (1975) point out some of the factors which affect the communication process. They argue that the type of communication which is important may be dependent upon the nature of the innovation. In addition, people will demonstrate different levels of resistance to innovations, depending partly on value, attitudinal and life-style compatibility. In the latter stages of diffusion, which depend more heavily on areal diffusion patterns, there is an inverse relationship between distance and the acceptance of a communication. Finally, institutional and cultural considerations (e.g., social class) will affect communication by molding networks and the uneven distribution of population will vary the opportunity to observe technologies.

The building industry itself may be a barrier to dif-

fusion. The industry consists primarily of small contractors who tend to be cost-conscious and conservative. However, there is some indication that they may be using solar in homes which they build for private investment purposes. In any case, the impact of the builders is twofold: they advise consumers regarding the viability of alternatives and the homes they build serve as models for later adopters. For this reason they are a crucial link in the adoption chain.

Finally, information, no matter how important or in which direction it heads, is still subject to interpretation by the potential adopter. Brock and Balloun (1967) report that experimental subjects were more likely to attempt to clear static out of consonant than dissonant information. Frey and Wicklund, however, say that factors other than dissonance -- intellectual honesty, curiosity, usefulness, attractiveness, or confidence -- may affect selective exposure. Since selective exposure is the product of certain prior conditions (such as values, norms and attitudes), it is to these that we now turn our attention.

Individual Characteristics

Values. Values, like norms may frequently serve as incentives or constraints (Shoemaker, 1981). Many researchers have, in fact, argued that values may be more important in the adoption of energy alternatives than in any other form of innovation (Leonard-Barton, 1981a, 1981b;

Warkov, 1981; Unseld and Crews, 1981). Sparrow (1978) argues that since early adopters are community leaders, then psychic satisfaction must act as an incentive. Unseld and Crew found that a desire to innovate and self-reliance were important characteristics of adopters. Many adopt solar because it is a clean, safe form of energy and they believe that use demonstrates social responsibility.

There is also evidence of an interaction between innovation and life patterns (Darley and Beniger, 1981). Leonard-Barton (1981b) has used a measure of voluntary simplicity (the degree to which people indicate performing a wide variety of conserving behaviors) and found that it was the second strongest predictor of adoption.

A wide variety of other values may also be correlated with adoption. Concerns for independence, family security, comfort, etc., all seem to be factors.

Cook and Berrenberg (1981) enumerate the variety of social incentives which can be employed to facilitate conservation, many of which apply to adoption. Providing social recognition and approval, seeking public commitments from individuals, or involving people in group decisions all facilitate conservation. To the extent that these conservation programs entail adopting energy-conserving technologies, all of these apply. But the provision of approval or social recognition should be a facilitating factor in any case.

Of course, the relationship between values or norms

and adoption may be mediated by the fact that people are receiving conflicting signals. At times they hear that there is an energy crisis, at other times it no longer seems to exist. While there continue to be statements regarding the diminishing reserves of oil, the world faces an oil glut. Thus, the knowledge which people have about energy issues, the attitudes that people develop, and the cues that they perceive, should also be related to adoption.

Knowledge, Attitudes and Cues. There is an obvious paradox with regard to the public's attitude about solar and the rate of adoption: the public at large is very pro-solar, yet this promise is not translated into behavior. Most people like the idea of solar power and favor government support. SERI (1980) reports that 2/3 of their respondents have named solar as one of the top energy sources of the future, and 1/3 actually say it is the most preferred. The Resources for the Future study says that solar is by far the energy source named most often as the one the U.S. should rely on by 2000 and a 1979 Roper study finds that only 16% of the respondents feel that solar will contribute very little to our energy needs (in Huttman and Graeven, 1982).

In spite of these favorable attitudes, most people indicate that they are not about to adopt alternatives. They do not think that it will be widely used in the next 5-10

years. Generally about 4% indicate that they either will or might purchase solar in the next 3-5 years (Huttman and Graeven, 1982).

Policies designed to encourage adoption could center on these considerations. Drawing on Bandura, the use of prestigious persons to model conservation behavior should facilitate this process. In keeping with the findings of Ehrlich (presented in Chapter 3), we should also increase the knowledge that people find necessary for both the recognition of and the implementation of appropriate behaviors (Cook and Berrenberg, 1981). Often, even if people are aware of actions, they will hesitate to take them if they feel that they lack competence. We should also increase attempts to minimize the perceived negative consequences of adoption (Cook and Berrenberg, 1981).

On the other hand, some studies, especially of conservation behaviors, demonstrate a greater correlation between attitudes and behavior. In a study of summer electrical consumption, Seligman and his associates (Becker, et al, 1981) found that attitudes concerning personal health and comfort, the relationship between effort and payoff, and the role of the individual in solving our energy problems account for 55% of the variance in summer electrical consumption. They also conducted two follow-up studies using these variables (with health and comfort now loading on separate factors) as well as with attitudes regarding the legitimacy of the energy crisis, science and technology,

and family finances. In the second study of summer electrical consumption, 59% of the variance was explained. However, these same variables accounted for only 18% of the variance in winter heating. Surprisingly, the legitimacy of the energy crisis never seems to be a factor, and family finances did not contribute to the explanation of winter heating.

It would seem at first that the difference is probably due to the fact that one set of studies deals with a behavior which does not demand as much sacrifice; that is, electrical consumption in the summer is not as much of a concern as heat in the winter. Certainly for some people air conditioners are extremely important to health and comfort. But the elasticity of the demand for heat is much lower than for cooling, so attitudes may not explain much of the variance. Yet in another study, Leonard-Barton (1981b) finds a number of attitudes associated with gas consumption: norms of voluntary simplicity (-.18), beliefs about the consequences of action (-.11), the belief in an energy crisis (-.15), and ecological activism (-.16).

This would seem to indicate that a number of mediating influences must be affecting the relationship between attitudes and behavior. Heberlein and Black (1981) feel that people who practice non-normative behavior exhibit greater cognitive consistency. In their study of lead-free gasoline users (conducted before federal law required its use), they found that those who felt a personal obligation and

believed that lead-free gasoline saved money were the most likely purchasers. They also argue that those who exhibit the greatest consistency between attitudes and behavior should have the greatest support from others, the most supporting beliefs, and the greatest behavioral commitment.

The formation and change of attitudes is enhanced when these attitudes receive continual confirmation from a variety of sources (Darley and Beniger, 1981). This points to a compounding variable in the study of attitudes and behavior. Especially with regard to energy conservation, the cues which people receive can be contradictory. Signals concerning the validity of the energy crisis, the amount of oil that remains, etc., may cause different reactions depending on how these cues are received.

If this is true, then people's perception of an imminent crisis may help to explain adoption. However, research results on this topic are mixed. Certainly many people are aware of the seriousness of the energy problem. In surveys, 40-60% of the respondents generally agree that the energy problem is a serious one (Olsen, 1981), but they differ in their interpretation of the causes. Some see it as the result of excess demand over supply, others feel it is due to waste, U.S. dependence on foreign oil, or the depletion of natural resources. Demographic correlates of this belief include education, income and occupation.

But, with the exception of the Leonard-Barton study, attitudes about the reality of the crisis have little im-

pact on behavior. Some studies (e.g. Sears, 1976; Hass, Bagley and Roger, 1975) find that perceived personal impacts are related to conservation actions, but perception of crisis was not related. In fact, Hass, et al (1975) report that in a study of the interaction between the noxiousness of a potential energy crisis and its perceived probability of occurrence, intentions to reduce energy consumption were affected only by noxiousness. It should be pointed out, however, that the third variable which was included in the theoretical formulation of the study, the availability of and perceived viability of a coping response was not included in the final research design. It may also be that the perceived seriousness of the energy crisis must be strengthened by other attitudes: the awareness of the overall ecological situation, felt personal responsibility, favorable attitudes toward the administration, issues of equity, voluntary versus mandatory measures, or the role of incentives over penalties (Olsen, 1981).

Cook and Berrenberg (1981) point out that attempts to encourage conservation behavior through attitudes focus on two approaches: promoting pro-conservation attitudes through persuasive communications and evoking attitude-consistent behaviors. Persuasive communications depend upon both the context in which the communication is received and the characteristics of the recipient. While there is obviously a great deal of disagreement over the

success of such tactics, the development of pro-conservation attitudes may facilitate the effectiveness of other conservation efforts.

The latter strategy may involve one of a number of approaches. Adoption may be encouraged by directing attention to conservation actions, by letting people with pro-conservation attitudes know that opportunities are available or that the time is ripe to adopt. A second approach would be to make attitudes more salient to behaviors by association with others or through the public statements of group leaders. In either case, the goal is to enhance the perception of the behavior as normative. The final approach would be to demonstrate that the adoption is consistent with a pro-conservation attitude.

In any event, it is essential that we examine the relative impact of attitudes which are consistent with the behavior under question, of communications regarding the viability of the an energy system, and of normative perceptions.

Situational Characteristics of Adopters

We must first ask whether people who purchase solar equipment are a distinct group. In fact, innovators do differ from the general population on variety of characteristics. They tend to be younger and from higher socio-economic backgrounds (Shama, 1981). In terms of household

income, solar adopters are above average, although there is a recent evidence of a shift to a more representative family (Sparrow, 1978). They are generally from professional-managerial occupations. Their educational level is also above average.

But the important question is not whether solar adopters differ from the general population but, rather, whether they differ in important ways from other new home purchasers. Fahrar-Pilgrim (1981) argues that demographic differences are not great enough to give us a good idea of who purchases solar. Warkov (1981), in a Connecticut study of solar retrofitting, finds that demographics correlate highly with initial interest but that they explain very little of the variance in adoption. Similarly, the Solar Energy Research Institute (1980) argues that education is more highly correlated with awareness than with positive attitudes toward adoption.

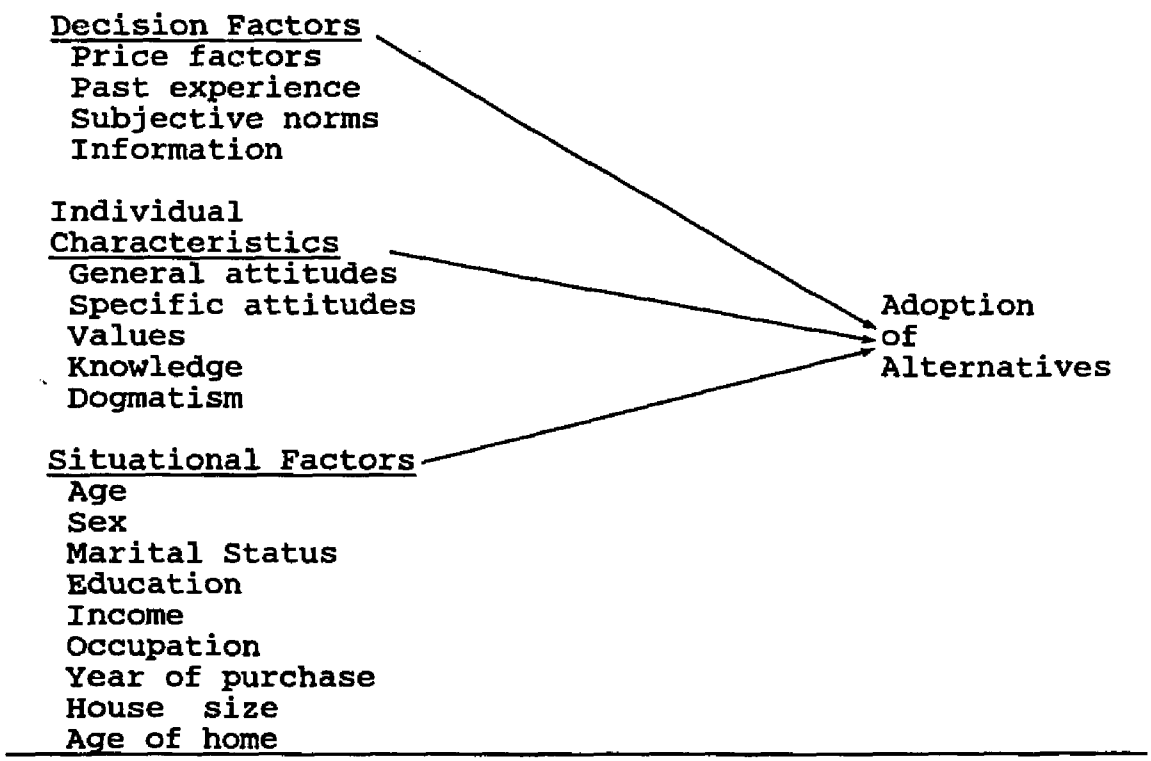
Thus, it would seem that the adoption process is not strongly influenced by situational characteristics. Still, we should be sensitized to the possible influences of demographic characteristics on attitudes and information networks, while not expecting them to explain a great deal of the adoption process independently of these other variables.

An Expanded Model

Table 4.1 presents a summary of the variable which we should examine based on the discussions of this chapter and the previous two chapters. A variety of factors may act to influence people's decisions. Here, however, we will split these up into those factors which were specifically involved in the decision, those attitudes and values which are more characteristics of the individual, and the situational (or demographic) variables which might constrain or influence a buyer's decision.

FIGURE 4.1

AN EXPANDED MODEL



Under the category of decision factors, we must first examine the role of price. This could include a number of different factors. First of all, there is the initial cost of the energy system to consider. This could act to encourage or discourage purchases, but it may well be mitigated by other factors like the potential for long-term savings. Finally, we must also consider the possible effect of tax credits in influencing the potential economic viability of different energy systems.

Our next consideration is the effect of past experience or habit. In addition, we have also included the effect of subjective norms -- the perception that the use of an energy system is acceptable -- as a factor which is directly taken into consideration with regard to the purchase decision. This variable might be regarded as a characteristic of the individual, but because it relies primarily on the observed frequency of use by other people, we have decided that it is something over and above individual characteristics.

Next, we turn to a groups of variables which might be classified as information and advice. Recall that advice may come from primary sources -- relative and friends -- or secondary sources -- in this case, engineers, builders, and salespeople. Information may also be derived from demonstration homes (which may or may not be established by salespeople) or from the media -- newspapers and magazines.

Turning to the characteristics of the individual, we

must be sensitized to the potential role of general attitudes about energy. While Fishbein might argue that these are not very good at explaining behavioral intent, much of the literature on energy adoption still sees them as important. Specific attitudes -- those about the various types of energy systems that are available -- should be better able to help us distinguish between different types of adopters or nonadopters.

Values which a respondent might hold should also give us insights into the adoption process. While not specifically indicators of lifestyle, they should still demonstrate the general inclinations of adopters or nonadopters.

Knowledge of energy issues should also play a key role. Without some awareness of energy, it is not likely that someone would purchase an alternative energy system. Finally in this category, many studies of adoption point to faults of the individual -- dogmatism in particular -- as slowing or hindering the adoption process.

Our next general category is that of situational or demographic characteristics. These may be of two types: the demographics of the respondent -- age, sex, marital status, occupation, education, or family income -- as well as the characteristics of the house -- the year in which the house was purchased (later for decentralized systems), the age of the home (younger for active or passive solar homes) and the size of the home (smaller for solar than for

traditional homes). These, then, are the basic categories of variables which we will examine in subsequent chapters.

Unresolved Issues

Despite the number of studies which have been conducted covering all the different aspects of adoption, there are still a number of unresolved questions. Unseld and Crew (1981), in fact, argue that our energy studies have raised more questions than they have answered.

To a large extent, this is due to methodological and theoretical shortcomings in this research. Down and Mohr (1976) blame the extreme variability in these findings on: 1) variations in the primary attributes of innovations (i.e., people compare very different types of innovations), 2) interaction effects, 3) ecological inference, and 4) varying operationalization of innovation. Similarly, Roessner (1981) argues: 1) that the narrow range of variables included in any particular study precludes the possibility of comparing the relative influence of these variables, 2) that comparisons of variables cannot be made across studies since different measure of innovations or different dependent variables have been employed, and 3) that since interactive models have not been employed, such effects remain hidden and hinder attempts to generalize across studies. For example, while no theory can predict the influence that cost will have in particular markets,

studies have produced a variety of findings. However, it is not clear whether the most important factor is first cost, lack of a warranty, long payback periods, etc.

Many studies rely on self-reports of energy conserving behaviors, and these always involve methodological problems, especially in trying to relate these self reports to savings. People may underreport if they fail to realize that actions save energy. At other times, people may rate high on a scale of reported behaviors by virtue of reporting a large number of conservation behaviors, all of which save only small amounts of energy (Olsen, 1981). This should not be a serious drawback in some aspects of this dissertation, since in many cases the behavior is concrete -- people either have or have not purchased an energy system. However, we are asking people to retroactively reconstruct their thinking regarding **why** they made their decisions, and the relative impact of variables can have changed over the years.

Unseld and Crew (1981) feel that the problems are also theoretical. They argue that the major drawback is the lack of any theoretical framework which can provide the basis for judging the validity of research results. They argue for more empirical knowledge derived from theoretically based research. Similarly, Shoemaker (1981) argues that attempts by diffusion researchers to develop broad classificatory schemes have not led to the development of a broad, explanatory theory.

Among the more important of the methodological issues is the ability to make significant comparisons between groups on a number of elements. First of all, we need to compare adopters of innovations with adopters of traditional technologies rather than with only the general public. Secondly, we need to be able to compare adopters of different types of alternatives. There will probably be different motivational considerations between people who adopt wood versus those who adopt active or passive solar, for example. Finally, we should also be able to compare those who think about adopting alternatives but decide against adoption with those who decide to adopt and with those who have never considered adoption in order to filter out motivational considerations as well as incentives and disincentives (Labay and Kinnear, 1981).

Implications for Research

These methodological approaches should also enable us to resolve some important theoretical issues which remain unanswered by virtue of our inability to compare groups across studies. First of all, do groups differ in their subjective expectations regarding the outcome of adoption (price, values) or in the sources of those expectations (information, modeling)? Do these variables seem to be either more relevant or more influential in decisions reached by adopters of different types of innovations?

Secondly, do adopters differ in any of a number of other characteristics? Does the amount of normative exposure vary? That is, do people who see these systems work for their neighbors or friends tend to be more likely to adopt? Do adopters of different technologies differ in any significant ways in demographic characteristics?

Finally, since the perspective presented in this dissertation emphasizes the importance of interaction effects, we should be able to answer some important theoretical questions. Why are people initially motivated to consider the adoption of innovations? Does the perception of crisis play an important role in motivation? More importantly, while attitudes do not seem to have a direct impact on adoption, do they have an indirect effect either through sensitizing people to cues or be mediating the impact of demographic variables?

In the following chapter, the basic methodological design of the dissertation will be presented and some preliminary questions will be addressed. In Chapter 5 we will begin to see how well the variables which we have included in this study can explain the rates of adoption.

CHAPTER 5

METHODOLOGY

Introduction

There are numerous methodological issues which must be addressed in this research. First, there is the problem of deciding who should be sampled in order to make the comparisons mentioned in the previous chapter. More importantly, there is the need to design a survey which will yield valuable information rather than simply replicate previous research. While the latter approach certainly leads to increased reliability of questions and increased validity of findings, if they do not expand upon our knowledge they seem to be less valuable.

In this chapter we will first examine the sample design. Following this, we will look at the construction of the questionnaire and see how the model is operationalized in this study.

Sample Design

The first step in the design of the sample was to select the population to be sampled. This dissertation is designed as an exploratory study geared toward determining the viability of the theoretical model presented earlier by

comparing groups of people who do or do not adopt specific types of energy systems for their homes. Because of this, the obvious choice for a population to sample was homeowners rather than the general public. Due to financial constraints, the survey population was limited to the state of New Hampshire. The survey was distributed in 1984.

Two major criteria determined the specific process which was employed in selecting the actual cases to be sampled. First of all, the sample was designed in a way that allows it to represent as closely as possible the conceptual universe. Secondly it was designed to facilitate the analysis which is to be conducted (Willer, 1968).

The simplest way to meet the first criteria is through random sampling. However, simple random sampling necessitates the identification of all of the elements in the population. In order to make this sample more cost efficient, a cluster sample was employed. While this introduces the possibility of a much larger sampling error, it has the advantage of allowing the researcher to concentrate efforts on fewer geographic regions and the cluster can be designed on the basis of readily available information (Jaeger, 1984; Kalton, 1983).

The simplest means of identifying a sample of homeowners in the state is through town tax records. The primary sampling unit selected was counties, 10 of which are designated in the state. The sample size was limited to 500 due to the cost considerations mentioned above. The

decision was made to sample the counties in proportion to their size in order to obtain as representative a sample as possible.

Because New Hampshire is such a small state, the proportion of people found in cities is very high. Ten cities, accounting for 30% of the states 386,381 households (according to 1980 census data) were therefore designated as a certainty sample. 150 of the 500 surveys were distributed to these 10 cities in proportion to their size.

The selection of the remaining cities and towns was conducted in a random manner. First, a cumulative listing of the number of households in each city was compiled for each county. The number of cities or towns (the secondary sampling unit) to be selected in each of the counties was based on the percentage of the total households located in that county. Since ten names were to be drawn from each town, the total number of cities in each county was determined by the total number of households to be sampled in that county.

For example, Belknap County has 24,004 households, or 9% of the state's total. Since there were 250 questionnaires to be distributed, Belknap County would receive 31. This meant that we would sample three towns in Belknap County. The towns were selected by first constructing a cumulative list. The sampling interval (S) was chosen by dividing the number of households by 3 (8001). Using a random start (R=5306), the first town to be selected was

the town where the 5306th household was located. The second town was determined by adding the sampling interval to the random start (5306 + 8001 = 13307). Other towns were selected in a similar manner (r+s, r+2s, r+3s...) until the total number of towns in the county were identified. Individual households were then randomly selected from property tax lists in each of the towns throughout the state.

Unfortunately, a random sample of homeowners is not likely to turn up enough people who have adopted alternative energy systems to allow for significant comparisons. For this reason, a second batch of surveys was mailed to a subset of people who were identified as adopters of alternatives through letters sent to solar builders and architects throughout the state. This subset amounted to 149, making the total number of questionnaires mailed 649.

Of this total, 189 people participated in the survey. This gives us an overall response rate of 29%. Of course, 149 of the potential respondents were people who had been identified as adopters. Of these 149 people, 72 of them (49%) chose to participate in the study. This number constitutes 36% of the total number of respondents.

Questionnaire Construction

Dependent Variables

Adopters. The first step was to identify those people who had actually purchased some form of energy system as their

primary source of heat. Respondents were asked to name their primary source of heat (oil, coal, gas, wood, solar, etc.) and to give a description (forced hot air, forced hot water, etc.). As a check against misunderstanding, respondents were also asked to estimate the amount of heat which comes from this source. These responses are tabulated in Table 5.1.

According to the 1980 census, based on a sample of the state we would expect to find 43% of households would be using oil. In our survey, oil represents 37% of the systems in all households. Natural gas, which according to the census is found in 32% of homes, is employed by only 6% of our respondents. Similarly, electric heat would be found in 21% of all households and here is limited to only 11%. Conversely, wood, which should be found in about 4% of all homes, and other forms of heat, which were expected to be in insignificant numbers, here make up 34% and 11% respectively (if we total all alternatives together). These differences are due to the fact that we specifically sought out owners of these alternatives. Thus they would make up a higher proportion of the respondents than the random sample in the census found.

Following this we had to identify which of these people were to be classified as adopters. Pre-tests of the questionnaire had demonstrated that just because people owned an energy system did not mean that they had actually made a decision to purchase this for their home. If they

TABLE 5.1

ADOPTERS/NONADOPTERS BY TYPE OF PRIMARY HOME HEATING SOURCE

	ADOPTERS		NONADOPTERS	
	Built-in	Installed	Acquired	Total
Oil	14	11	45	70
Coal	2	1	0	3
Electric	11	1	8	20
Natural Gas	1	5	5	11
Wood	16	47	1	64
Passive Solar	7	0	0	7
Active Solar	3	0	0	3
Wood and Oil	1	2	0	3
Active and Passive	1	2	0	3
Wood and Solar	3	1	1	5
Total	59	70	60	189

had not made the decision, then they cannot be classified as adopters.

To solve this predicament, all respondents were asked to check which of three statements applied to them: 1) Did they have the system built into the design of the house, 2) Was the system installed after the house was purchased, or 3) was the house simply acquired with the system already installed. For each situation, they were also asked to give the year of the purchase (which in situation 1 or 3 would be the year that the house was purchased).

Persons who responded in the affirmative to either question 1 or 2 have been classified as adopters. These respondents made a conscious decision to purchase an energy system. It is possible that the type of energy system which is already found in a home that people purchase may

act to influence those decisions, but that is not generally a determining factor in those purchases. It would seem to be most important for those people who purchase solar homes, but only one solar owner fell into this category.

Respondents were further classified as adopters of either centralized or decentralized energy systems depending on their previous description of their primary energy system. Those who has actually adopted oil, coal, natural gas, or electric heat have been designated as centralized adopters. As discussed in Chapter 1, while the distribution networks of some of these energy forms may be decentralized, the manufacture and, especially, the pricing of these sources is fairly centralized, especially in comparison to wood or active and passive solar systems.

Returning to Table 5.1, we see the distribution of these categories. Those individuals who either had some form of energy system built into the design of the house or installed after the home was built are classified as adopters (N = 129). Those who acquired their house with a system already installed are seen here as non-adopters (N = 60). These adopters are further subdivided into centralized adopters (above the line, N = 46) or decentralized adopters (below the line, N = 83).

Aware non-adopters. The best way to identify the variables which actually discourage the purchase of decentralized energy systems is to compare those who decide against

the purchase with those who actually make the purchase. So, we also asked people whether or not they had seriously considered the purchase of a decentralized energy system, either wood, active or passive solar, windmills, or photovoltaics. If they had seriously considered such a system, we then asked them to answer a series of questions (see below) for the system that they had most seriously considered. These respondents are labeled aware non-adopters.

For purposes of this dissertation, we will have isolated only two groups of aware nonadopters: those who considered solar alternative and those who considered wood alternatives. These comparisons make the most sense because we can then compare them with solar adopters and wood adopters, both of which are subcategories of all decentralized adopters. In terms of our attempts to understand what might discourage adoption, it makes more sense to compare people who have considered and rejected an alternative with those who actually purchase it than it does to compare adopters with some general category of people who have never gone through the same type of decision process. For example, wood adopters probably talk to different people than solar adopters, look for information in different places, etc.

Among our respondents, we have 17 people who have adopted some form of solar energy (active or passive solar, active and passive combined, and wood and solar combined).

We will compare these 17 people with all of the people (other than these 17) who thought about but rejected a solar system of some sort (photovoltaics, solar hot water, passive solar, or a greenhouse). This latter group contains 65 people. Our other dependent variable will include all of those people who indicated that they had purchased some form of wood heat (70) compared to those who thought about wood but decided not to adopt (23) and were not in the category of wood adopters.

Unaware Nonadopters. Finally, it might also be informative to compare adopters with nonadopters. Here we will first compare all of our nonadopters (59) with all of our adopters (111). We lose a few people from our total number of respondents because in order to construct the variable it was necessary to select from two separate variables, and some of the respondents were missing in one or the other. For example, someone who might have been an adopter might not have answered the question that asked whether or not they had ever considered a decentralized alternative. For this reason, in any of the analyses, they would be dropped as missing, even though they had answered the question about the type of energy system they had purchased. If we examine a cross tabulation of these two variables (Table 5.2), we can see that there were 72 people who never considered a decentralized system and 98 people had considered it at some point.

TABLE 5.2

BREAKDOWN OF ADOPTERS/NONADOPTERS BY CONSIDERED/DID NOT CONSIDER AN ALTERNATIVE

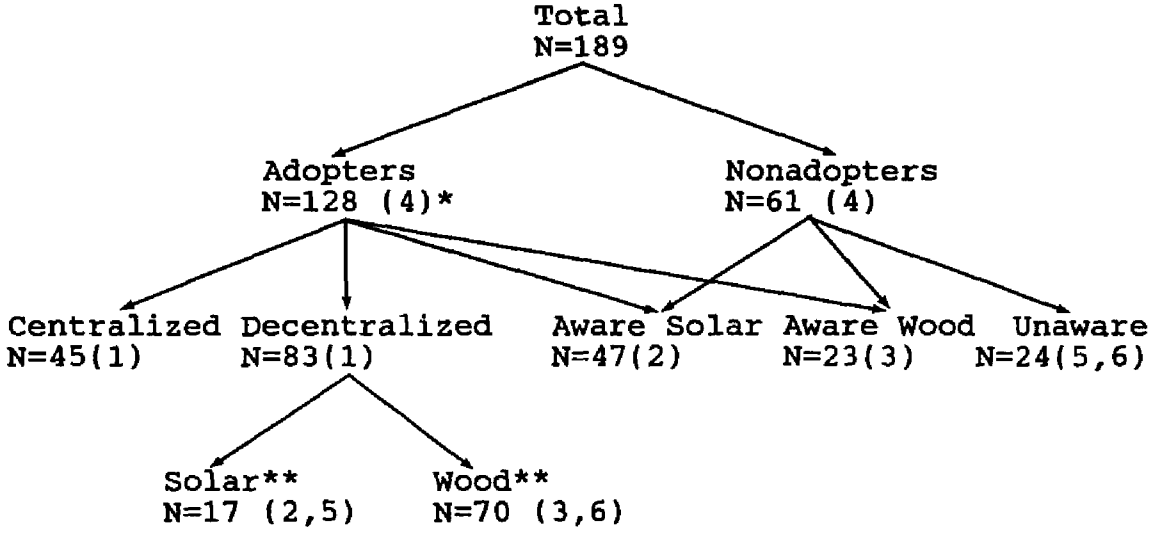
	Nonadopter	Adopter	
Did Not Consider	25	47	72
Considered Alternative	34	64	98
	59	111	170

We can also use this table to sort out those people who would be identified as unaware nonadopters -- those respondents who have never purchased and never thought about purchasing a decentralized energy system. Such people would be classified as unaware nonadopters. In Table 5.2 we see that the number of people who fit this category is only 25. While this is a limited number of people, we can still make adequate comparisons with solar and wood adopters.

Another way of summarizing these breakdowns is evident in the tree presented in Figure 5.1. Beginning at the top of the table, we see that we started out with 189 respondents. Of that number, 128 were adopters and 61 were nonadopters. We can further break the adopters down into 45 people who adopted a centralized system and 83 who adopted a decentralized system. The 83 decentralized adopters can be further broken down into 17 solar adopters and 70 who

Figure 5.1

SUMMARY BREAKDOWN OF ALL RESPONDENTS



* Numbers in parentheses indicate the comparison in which this group is used.

**Four cases (combined wood/solar) are included in both of these comparisons.

purchased wood. (There are actually 4 respondents who adopted a wood/solar combination. They have been included in both comparisons, since the comparison groups are total ly separate and these two groups are never compared to each other.)

Our aware nonadopters (those who thought about some decentralized alternative but subsequently decided not to adopt) are drawn from either the adopters or the non-adopters (i.e., they may or may not have subsequently purchased some system other than the one under consideration).

We see in Figure 5.1 that there are 47 people who considered solar and did not adopt. These people will be compared to those who did adopt some form of solar. There are also 23 respondents who considered adopting wood and then decided against the purchase. These people will be compared with those who purchaed wood systems. All of this leaves us with only 24 people who have never thought about adopting any form of decentralized system and also never purchased any centralized system.

We need to look now at the independent variables which we will be using to search for differences between these groups. Let us turn to these variables as they were presented in our model.

Independent Variables

Situational Variables. Much of the design of the questionnaire was rather straight-forward. Because there is such a marked relationship between demographic variables and the belief in an energy crisis, the beginning of the survey asked respondents to answer a series of demographic questions. Age has been coded as a continuous variable. Sex has been coded as a nominal variable (0 = male, 1 = female). Similarly, marital status is a dummy variable (0 = married, 1 = not currently married). Education ranges from 8 through 15 (13 = some college, 14 = BA/BS, 15 = some graduate school). Duncan SEI is derived from a description

TABLE 5.3

DESCRIPTIVE STATISTICS FOR
DEMOGRAPHIC VARIABLES

	NON-MISSING N	RANGE LOWER	RANGE UPPER	MEAN	STDEV
AGE.....	188	27	81	48.46	13.29
SEX.....	188	0	1	.31	
MARITAL STATUS.....	188	0	1	.16	
EDUCATION.....	187	8	15	13.78	1.34
DUNCAN SEI.....	157	15	96	60.11	19.87
FAMILY INCOME.....	179	1	12	6.69	2.34
HOUSE AGE.....	189	1	225	39.63	50.05
HOUSE SIZE.....	188	3	15	7.27	1.96
YEAR PURCHASED.....	187	41	83	72.89	8.39

of their occupation as coded in the Duncan socio-economic index. Income is a categorical variable that has been developed by breaking down the reported income of each member of the family according to the following scale: 0 to 6,000 = 1; 6,001 to 12,000 = 2; 12,001 to 18,000 = 3; 18,001 to 24,000 = 4; 24,001 to 36,000 = 5; 36,000 to 48,000 = 6; 48,000 to 72,0000 = 7; and 72,001 and up = 8. Family income has been derived by adding the scores for the respondent and the respondent's spouse together, giving a potential score of 1 to 16.

In addition, respondents were asked to answer a few questions regarding their home: the year in which it was purchased (only the last two digits of the year have been used, thus 69 = 1969), the approximate age of the house, and the house size (number of rooms). All of these are continuous variables. The descriptive statistics are pre-

sented in Table 5.3.

The median age of the respondents to this study is 45. This seems quite high in comparison to the median age for the state, which in the 1980 Census was 30.1. This is understandable to some extent since the survey was sent only to homeowners who would tend, on average, to be older than renters.

Most of the other characteristics are not so readily comparable to the census data. The median education for the state (people 25 years and older) is 12.6 years. In this study, where the youngest respondent is 22, the median years of education is 14. This means that we have a somewhat more educated sample, but that would tend to be the case with a mailed survey, especially one that was limited to homeowners.

The median family income for the state is $22,132. The data in the survey were coded on a scale, the median of which is 7. This would correspond to much higher income level (in the range of 36,000 to as high as 72,000 and above). One might also expect that this would be the case, since homeowners will tend to have higher than average incomes, but this factor combined with the higher education would lead us to conclude that this sample is a higher class segment of the population than we might expect to find in a truly random sample of the entire population.

This is also borne out in the analysis of the homes. The median number of rooms in the state is 5.2. Here we

find that houses are larger, with a median of 7.0. Given the higher incomes, we might expect larger houses. On the other hand, passive solar homes, especially those of post and beam construction, tend to have fewer rooms and more open space for air to circulate well from room to room. A better indicator might have been square footage, but data of this type are usually much more difficult for people to obtain. Similarly, data on house values, subject to differing appraisals, etc., is difficult to obtain and compare.

Those respondents who indicated that they had made an active decision to adopt were then asked to respond to a series of questions about what factors were important in helping them to arrive at their decision. It is to these questions that we now turn.

Decision Factors

People attempting to make the best decisions they can under difficult circumstances may take a wide variety of factors into consideration. Here, people were asked to indicate not only whether a certain factor entered into their decision but also the degree and the direction of that influence (i.e., whether these variables encouraged or discouraged their purchase). This was an intended to compensate for what was perceived to be a serious flaw in previous studies. Most of the studies of this type will at-

tempt to discover whether or not people who adopt an innovation were influenced by certain variables. However, this influence may be either positive or negative. Frequently a second set of questions is designed to determine if people approve or disapprove of different types of incentives. A comparison of responses among people who adopt specific alternatives is then made in order to determine whether incentives tend, on the average, to encourage or discourage adoption.

In this study, such a comparison was made in only one step and the effect of these decision factors can be tied more readily to adoption. The range of these variables is from 1 to 5 (1 = very discouraging, 5 = very encouraging). Respondents were given the option of saying that a variable has no impact. Such responses have been coded here as neutral (3). This is a subjective interpretation and it may be seen as an arbitrary means of coding this variable. However, it is probably no less arbitrary than to attempt to break the variable down into a nominal variable, coding discouraging as 0 and encouraging as 1. In the latter case, there would still be a subjective decision regarding how to classify the no impact response. Not only is the method chosen as reliable as any other, it helps to preserve more of the original data. The (non-missing) responses to these factors are presented in Table 5.4. For purposes of discussion, we shall break these variables down into groups of similar variables.

TABLE 5.4

ADJUSTED FREQUENCIES OF
DECISION VARIABLES

	DISCOURAGING		NEUTRAL	ENCOURAGING		
	Very	Some what		Some what	Very	TOTAL
Initial Cost.....	3.3	15.0	22.5	25.8	33.3	99.9% (N=120)
Long-term Savings.....	3.3	2.5	11.7	20.8	61.7	100.0 (N=120)
Tax Credits.....	6.1	2.6	69.6	13.0	8.7	100.0 (N=115)
Owned One Before.....	0.8	0.0	71.2	12.7	15.3	100.0 (N=118)
Relative Owned One....	0.0	3.5	57.5	22.1	16.8	99.9 (N=113)
Relative's Advice.....	0.0	4.5	57.1	23.2	15.2	100.0 (N=112)
Salesperson's Advice..	1.8	0.0	79.6	15.9	2.7	100.0 (N=113)
Engineer's Advice.....	0.0	0.9	73.0	15.7	10.4	100.0 (N=115)
Builder's Advice.....	0.0	1.8	73.0	10.8	14.4	100.0 (N=111)
Demonstration Home....	0.9	0.0	87.5	8.0	3.6	100.0 (N=109)
Newspapers.....	0.0	3.7	46.8	34.9	14.7	100.1 (N=109)

Price Factors

Three variables are concerned primarily with price: the initial cost, the long-term savings, and the tax credits. Cunningham and Lopreato (1977) have argued that price is a major factor, especially among low and middle income purchasers. Similarly, Boaz-Allen says that recent owners install for economic reasons. But we felt here that price should be examined in different ways. Shama (1981) says that it is high first cost that leads to rejection.

According to this data, the vast majority of people found this factor to be either encouraging (59.1%) or neutral (27%). This is to be somewhat expected since these people actually adopted the energy system that they considered. What is interesting, however, is that so many people would actually adopt an energy system that they found discouraging because of its large initial cost (18.5%).

Darley and Beniger say that people may informally calculate the potential savings prior to adoption and that this perceived savings is an important consideration in their purchase. Here, only 5.8% were discouraged by the possibility of long-term savings (or the lack of long-term savings).

Tax credits have never been a very important factor. The SERI study found that it only ranked 10th among adopters of solar equipment, and that only 1/2 of their respondents thought that it was important. Similarly, Marsden (1980) says that relatively few homeowners have taken advantage of these credits. Here we see that for nearly 70% of those who actually adopt some system, tax breaks had no impact. When they do have an impact, it is more often encouraging (21.7%) than discouraging (8.7%).

Norms and Habits

People need detailed, first-hand experience. For that reason, we decided to see how many people had purchased an energy system because they had owned one before. The

largest response is for those who people who say that having owned one before had no real impact on their decision (44.4%), which, of course, is not to say that they had not owned one previously. Again, when it does play a role, it tends to be encouraging (28% of the total, 97% of the non-neutral responses). Of course we would not expect people to adopt an energy system that they were unhappy with in the past.

We defined norms earlier as expected patterns of behavior. Those behaviors which are most often observed and which are enforced through positive and negative sanctions will become accepted as standards. Models of market penetration assume that the probability of adoption at time T is a function of the number of previous adopters (Shama, 1981b). Lowe and Moryadas state that the uneven distribution of the population varies the opportunities to observe successful adoptions. In this study we have two different measures of normative perception. First of all, Table 5.4 gives us the impact of the ownership by relatives of systems similar to those which had been purchased by the respondent. This is our variable Relative Owned.

We have also been able to develop a measure of the number of adopters that our respondents may know, but we are not able to tell whether or not they knew them prior to making a decision about their own energy systems. To measure the degree of normative exposure, respondents were asked how many people they knew who owned certain types of

energy systems, including photovoltaics, solar hot water, passive solar homes, greenhouses, windmills or wood stoves.

This set of responses posed more problems than other variables in the study. First of all, many of the responses were ambiguous: "many", "lots", "everybody I know". These responses have been given the mean score of all responses.

The next difficulty was the extreme outliers of the responses: 1000, 2000, etc. In order to deal with these scores, a new variable was created for each of the six types of energy systems by taking the log of the variable. By adding together these logged variables, we have created a new variable which we shall call TOTAL EXPOSURE. The mean values of these logged responses and the newly created variable are reported in Table 5.5.

Information

Lack of information is usually the 1st or 2nd greatest hindrance to adoption. According to our model as well as previous research, we must also recognize that information can come from a variety of networks. Darley and Beniger point out that decisions are affected by interpersonal networks. We see these as being of two types, those that reflect input from primary reference groups versus those of secondary groups. Lowe and Moryadas say that the type of contact depends on the nature of the innovation. Here we shall just consider all adopters.

TABLE 5.5

DESCRIPTIVE STATISTICS FOR
EXPOSURE VARIABLES

	NON-MISSING	RANGE			
	N	LOWER	UPPER	MEAN	STDEV
Photovotaics.....	14	0	6.66	.81	1.75
Solar hot water.....	113	0	3.00	.72	.79
Passive solar home...	94	0	3.40	.76	.78
Greenhouse.....	117	0	2.49	.72	.73
Wood stove.....	180	0	7.60	2.64	1.22
Windmill.....	34	0	1.61	.25	.47
TOTAL EXPOSURE.....	189	0	7.61	2.82	1.26

To measure the impact of primary groups, we asked people what influence relatives had on their decision, either through the advice that relatives gave them or through their experiences with similar systems (Relative Owned One). Returning to Table 5.4, we find once again that in the majority of cases this was not a factor (57.1% and 57.5% respectively). On the other hand, the advice that relatives gave them and the experiences that they had were never very discouraging. In fact, they tended to be encouraging to about the same degree in both cases. You might expect these to fluctuate together since the advice that the relative's give should coincide with the experiences that they have with these systems. On the other hand, such an expectation assumes that these relatives are always happy with the energy systems that they are using. Certainly, that would seem to be the case based on this data, but it is an empirical question that can only be examined by looking at both of these variables together.

What we have referred to here as secondary group information can come from a variety of resources: builders, engineers, salespeople, demonstration homes, or newspapers. The building industry may often be a barrier. Builders are likely to want to build the sort of homes that they are used to building, which means that they will tend to recommend traditional systems. In this survey, the advice of builders usually had no impact (73%). In only 2 cases (1.8%) was it a negative factor. In another 25.2% of the cases it was encouraging. It would seem from this that most people have made decisions prior to talking to builder or, if the home is already built, without talking to a builder or contractor.

On the other hand, the advice of both salespeople and engineers, the obvious alternatives to builders, was also overwhelmingly neutral, as was the last category that might be included with the building trades, demonstration homes. As with other variables, when they do have an impact it tends to be encouraging. On the other hand, they either offer a lot of contradictory evidence and are thus discounted or they simply do not enter into people's decisions at an early enough point to really affect their considerations.

The final variable in this category is newspapers. Here we find more evidence of an impact, and one which again is overwhelmingly positive when it enters into decisions. It was encouraging for 49.6% of the respondents and

neutral for another 46.8%.

Individual Characteristics

Attitude Variables. All of the respondents were next asked to answer a series of questions designed to determine their attitudes about a variety of energy issues. These questions (see Table 5.6) fell into a few broad categories: the degree to which people favored solar power, the perception of an energy crisis, the degree to which people feel personally affected, the types of solutions that people felt were viable, and the degree of support for the government's policies. Table 5.6 gives the adjusted (non-missing) responses to these questions.

As stated before, many people tend to think favorably of solar power. Huttman and Graeven state that 2/3 of the general public think that solar is one of our top energy sources. 1/3 even say that it is the most preferred energy source. They like it for homes and they tend to favor government support.

Here we find support for these earlier findings. We have tried, however, to itemize some of the characteristics of solar power in order to find our what it is that they find appealing and what might lead them to be disillusioned with this energy source. First of all, our respondents seem to find solar to be a viable alternative. People disagree with the statements that solar will not contribute to

TABLE 5.6

ADJUSTED FREQUENCIES OF
ATTITUDE RESPONSES

	Disagree Very much	Some what	Neutral	Agree Some what	Very much	
BIG INVESTMENT:The biggest problem with solar power is that it requires such a large initial investment.....	7.6	8.1	9.3	44.2	30.1	(N=172)
SOLAR NO HELP:Solar power will never make a significant contribution to our energy needs.....	52.5	28.7	8.3	6.6	3.9	(N=181)
SCIENCE HELPS: Scientists will be able to develop new forms of energy before we have another crisis.....	27.0	32.5	20.2	13.5	6.1	(N=163)
TOO MECHANICAL: Only people with a lot of mechanical ability should own a solar home.....	61.2	24.2	6.7	6.7	1.1	(N=178)
CAN'T MEET ENDS: Energy prices make it extremely difficult for my family to make ends meet.....	35.3	17.6	16.6	18.2	12.3	(N=187)
SOON OBSOLETE:The solar technology now on the market will probably be obsolete in 5-10 years.....	11.3	17.6	23.3	29.6	18.2	(N=159)
USE AS AFFORDABLE:People should be allowed to use as much energy as they can afford.....	47.3	17.4	11.4	11.4	12.5	(N=184)
TOO COLD:While solar homes are great for warm, sunny climates, it is too cold and cloudy for them where I live.....	46.1	25.3	11.2	9.6	7.9	(N=178)
NUKES SAFE:While some may disagree, I think that nuclear power is safe and we should be putting even more money into it...	47.3	6.5	9.8	16.3	20.1	(N=184)

TABLE 5.6 (continued)

ADJUSTED FREQUENCIES OF ATTITUDE RESPONSES

	Disagree Very much	Disagree Some what	Neutral	Agree Some what	Agree Very much	
NO SHORTAGES:We need not worry about future energy shortages because America has a wide variety of resources.....	67.8	20.8	6.6	2.7	2.2	(N=183)
RAISE TAXES:The government should place higher taxes on gas and oil in order to discourage consumption.....	44.3	21.9	16.9	12.0	4.9	(N=183)
DOUBLE SOLAR FUNDS:The government should immediately begin to at least double its funding for solar research and development.....	8.2	7.7	14.3	22.5	46.2	(N=182)
ENOUGH OIL:This country still has plenty of oil, we just need to find it.....	49.7	26.6	10.7	9.5	3.6	(N=169)
STOP NUKES:We should immediately put a stop to the building of all nuclear power plants.....	38.3	11.1	12.2	10.0	28.3	(N=180)
SHORTAGE INEVITABLE:Another energy shortage seems to be almost inevitable.....	5.1	10.9	18.9	38.9	26.3	(N=175)

our energy needs (81.2%). And they do not think that it is too cold where they live for solar to be practical (71.4% disagree).

On the other hand, we must ask some questions about how much trust they have in the systems. Shama says that people do not necessarily find systems unreliable. In this

study we see that people tend to disagree that only mechanical people should own a solar home (59.5%). Darley and Beniger, on the other hand, say that the experimental nature of the technology leads people to question its viability. Here we find that a large number (47.8%) feel that the technology now on the market will soon be obsolete.

Finally, we must explore people's opinions about cost considerations. Again, Darley and Beniger sensitize us to the fact that perceived savings are important. This study indicates that people believe that solar requires a large initial investment (74.3%). This and the concerns about the technology would appear to be the biggest deterrents to adoption. These ideas, which we shall explore more fully in later sections (especially the issue of initial cost), may point to a need for more information (Shama, 1981a).

We must also see if there is some way to change this generally positive support for solar power into a more active support. One way might be to convince people of the existence of a crisis. Becker says that the perceived legitimacy of the crisis is important. Similarly, Leonard-Barton and Rogers correlate the perception of a crisis with the amount of gas consumed. Here, though, we find that people already tend to think that there is a serious problem. The majority disagree that we have plenty of oil (76.3%) and that there is no problem because we have so many resources (88.6%). Furthermore, they tend to agree

(65.2%) that another shortage is inevitable. This would tend to undermine Shoemaker's assumption that people are getting confusing signals about the energy crisis, the amount of oil, etc. and to provide support for Olsen's statement that most people are already aware of the seriousness of the problem. But we find that this is not enough to translate their support into action.

Another factor might be the extent to which they support the government's policies. We find here that they are against nuclear power. 71.4% disagree that nuclear power is safe. But they certainly do not want to put an immediate stop to the building on nuclear plants (49.4% disagree). Furthermore, they would like to see the funding of solar research doubled (68.7%).

Becker says that the degree of belief in science and technology as a solution to our problems helps to explain the amount of electrical consumption. If people think that science will solve our problems they are more likely to continue on their old paths now. Here we find that they do not see science as a solution (59.5% disagree that science helps). This is in contrast to their belief that the government should double the amount of solar funding, which would seem to imply that research and development efforts would lead to success.

Perhaps the best explanation of why general support is not translated into action is that people do not feel personally affected by the perceived crisis. Hass, Bagley,

and Rogers argue that it is not the perceived seriousness of the problem but the anticipated personal inconvenience which is important in explaining people's behavior. In this study we find that people do not think that things are so bad that they can't make ends meet (52.9% disagree). And they do not favor actions by the government which would make things more difficult for them. Most (66.2%) disagree that the government should raise taxes to discourage consumption. Similarly, many (47.8%) feel that people should be able to use as much energy as they can afford.

We are left, then, with a need to consider why people might be inclined toward the adoption of alternatives such as solar and yet fail to make a commitment to purchase an alternative system. Two partial explanations may be indicated by these preliminary findings: they believe that solar is too costly and the technology is tentative.

Due to the large number of variables that were included in this section, we also decided to factor analyze these variables to see if any of them would cluster together in ways other than we had originally intended. Using SPSS with an oblique rotation, we found that there were a few underlying factors that seem to make sense and which were also distinctly different at times from the way that we had originally designed the questions. The rotated pattern matrix appears in Table 5.7.

The first four of these factors seem to go together theoretically. In Factor 1 we find 3 variables which would

appear to deal with attitudes toward the viability of solar power and one variable which deals with solutions to our energy problems. Since the last variable does not seem to make any theoretical sense and since it loads on this factor much less heavily than the other three variables, we

TABLE 5.7

ROTATED PATTERN MATRIX FOR ATTITUDINAL VARIABLES

	FAC 1	FAC 2	FAC 3	FAC 4	FAC 5
SOLAR NO HELP	.80				
DOUBLE SOLAR FUNDS	-.63				
TOO COLD	.62	.33			
USE AS AFFORDABLE	.45				
SOON OBSOLETE		.70			
TOO MECHANICAL	.31	.60			
BIG INVESTMENT	-.30	.58	-.47		
NO SHORTAGES	.32		-.72		
ENOUGH OIL			-.71		
SHORTAGE INEVITABLE	-.34	.32	.36		
STOP NUKES				.93	
NUKES SAFE				-.91	
RAISE TAXES					.79
SCIENCE HELPS			-.32		-.57
CAN'T MEET ENDS				.33	-.52

have opted to exclude it from this factor. By reversing the coding on the variable Double Solar Funds and adding these three variables together, we have developed a new variable which we shall refer to in subsequent analyses as NOSOLAR. It has a range of 3 to 15.

The second factor might not appear at first glance to

make theoretical sense. Certainly the variables do not cluster together in the way that we had anticipated. The first two of the variables deal with the technology of solar power while the final variable was designed to measure price considerations. However, the initial investment may appear to be large because of the tenuous nature of the technology. These variables also seem to load on this factor to about the same degree, so we have added them together creating another variable which we shall call TOOTECHY.

In Factor 3 we find three variables which would appear to be concerned with the seriousness of the energy crisis. The first two of these variables deal with whether or not people think that there are enough energy resources for us to survive. Both of these questions load heavily on this factor. We might also assume that the third variable would be included in this factor, since it seems to theoretically cluster with the other two. However, it does not load heavily on this factor (or any other factor) and does not meet any minimum criteria for inclusion. Thus, we will add together the first two variables -- No Shortage and Enough Oil -- to create a new variable called PLENTY.

Factor 4 is the most obvious of the group. Both of the variables deal with nuclear power. Here we have reversed the order of Nukes Safe and created a variable called NONUKES.

The last factor creates some problems. They all load

at above the .5 level on this factor but they do not make any theoretical sense. Raising taxes was a policy issue. The belief that science will solve our problems does not seem to go well with this variable. Finally, Can't Meet Ends deals with feelings of being personally affected. Some sense could be made of the first or third variables, but the second one does not fit in at all. Since it does not seem logical to leave out the middle variable in a cluster, we have decided that this factor is simply an artifact (i.e. these variables are explaining a large part of the remaining variance) and we will not use it. We will also continue to use all of the other variables which have not been included in these composite variables.

In keeping with the model presented in the last chapter, we will divide these attitude variables into two groups. The first is the General Attitudes: Science Helps, Can't Meet Ends, Use As Affordable, Raise taxes, Shortage Inevitable, and PLENTY. We also have three specific attitudes: NONUKES, NOSOLAR, and TOOTECHY.

Lowe and Moryadas argue that value compatibility will tend to moderate these other influences. Shoemaker says that values may serve as incentives or constraints to adoption. For that reason, we will now turn to a consideration of the impacts of values on decisions.

Values

The idea of voluntary simplicity has been shown to be

a strong predictor of adoption of solar alternatives. Leonard-Barton and Rogers said that it was the second strongest predictor of adoption. Here we have measured only one aspect of simplicity, that of independence. This seems to be an important variable for almost anyone who adopts. In Table 5.8 we see that 78.1% of the respondents were encouraged by the desire for independence. For 20% it was not an impact, but that seems low in comparison to many

TABLE 5.8

ADJUSTED FREQUENCIES FOR VALUES

	DISCOURAGING		NEUTRAL	ENCOURAGING		
	Very	Some what		Some what	Very	TOTAL
Independence.....	1.7	0.0	20.0	19.1	59.1	99.9% (115)
Clean Energy.....	3.5	19.1	13.9	28.7	34.8	100.0 (115)
Innovative Technology.	0.0	6.3	55.9	25.2	12.6	100.0 (111)

of the other variables we have examined.

The second of these variables, Clean Energy, shows much more variation. While 63.5% found this to be encouraging, 22.6% were discouraged by the fact that the type of system they adopted was not very clean. There could be some confusion here (which failed to show up in the pretest) about what is meant by clean energy. "Clean energy" could imply energy that is clean either in its use (like electricity in the home) or in terms of its impact on the

environment (unlike electric energy generated from coal fired power plants). If people are interpreting this in entirely different ways, then this could be more of a problem in later analyses.

Finally, we need to consider the importance of innovativeness in people's decisions to adopt. Unseld and Crew state that adopters are interested in technology and desire to innovate. Lowe and Moryadas say that each individual has a different level of resistance to innovation. Finally, Darley and Beniger believe that there is an interaction between innovation and life-pattern interaction. In any event, this would seem to be an important variable for adopters. In this study, we find that for half of the adopters this variable had no impact. On the other hand, it was only a discouraging aspect of the technology for 6.3% of the respondents and acted to encourage 37.8%.

Knowledge

On the basis of the findings presented in Chapter 4, it was also anticipated that the amount of knowledge people have about energy matters might be an important factor in their decisions to adopt alternatives. Let us turn now to the indicators developed to measure these factors.

Arbuthnot (1977) says the environmental knowledge is the 2nd best overall predictor of adoption. Here we have designed a series of questions to test people's knowledge about energy-related issues (Table 5.9a). These statements

TABLE 5.9a

ADJUSTED FREQUENCIES
OF AWARENESS QUESTIONS

	TRUE	FALSE	DK	TOTAL
TURN DOWN HEAT:Turning down the heat at night saves less energy than it takes to reheat it in the morning.....	23.4	70.2	6.4	100.0% (N=188)
CONSUMPTION:On a per person basis, energy consumption in the United States is still the same as it was in 1960.....	4.2	73.0	22.8	100.0% (N=188)
PASSIVE COSTS:When you consider both energy costs and mortgage payments, passive solar homes cost more than traditional homes.	17.0	46.8	36.2	100.0% (N=188)

TABLE 5.9b

DISTRIBUTION OF RESPONSES FOR
VARIABLE KNOWLEDGE

N OF CORRECT RESPONSES	ABSOLUTE FREQ	ADJUSTED FREQ
0	15	8.0
1	40	21.4
2	82	43.9
3	50	26.7
TOTAL	187	100.0

are not regarded here as subjective in nature but are verifiable in terms of their content. The majority of-people gave the correct response to each of the questions (Table 5.9a).

The first question, regarding whether or not it is more efficient to turn down the heat at night, is false. While certainly there can be some individual variation (depending on the mass of the house, the general house design, etc.), in general as long as the heat is down for 8 hours or more you save more heat than you use to reheat the house in the morning (thus the proliferation of thermostats that do exactly this on a regular basis, thereby saving the homeowner the need to worry about always remembering to turn it down at night).

The second question is also false. Per capita energy consumption in the United States is about twice as high as it was in 1960. Here we see that 132 people actually got this correct.

The final question was apparently the most difficult. For the average solar home, the actual monthly payments are less than for traditional homes because the energy costs are so high for the latter (New Hampshire Governor's Energy Council, 1981).

The next step was to change these into dichotomous variables. For this purpose, correct responses have been coded as 1 and all incorrect responses (including don't knows) have been coded 0.

Finally, rather than using each of these variables in the analysis, the decision was made to develop a cumulative index by adding together the scores on the individual questions. The result is a new variable, KNOWLEDGE, with a

range of 0 to 3. The distribution of Knowledge is reported in Table 5.9b. Only a few people (15) got all of the answers wrong. The mode is 2 and the mean is 1.97.

Dogmatism

Finally, it would seem that the degree of openness possessed by individuals could be an important consideration in terms of its effect on people's willingness to try out new ideas or even in their receptivity to novel information. The approach which we have developed here sensitizes us to the fact that people will be differentially receptive to information. Following Bandura (1976) we must try to measure the amount of openness of people to new information. Here we actually measure the obverse of openness, dogmatism. This variable has been explored throughout the social psychological literature, but here we have chosen to use four of the top five questions of a scale developed by Triandis (1971). The actual questions are reported in Table 5.10.

These variables, like the attitude questions, were coded on a scale of 1 (disagree very much) to 5 (agree very much). The distributions are reported in Table 5.10. These questions were asked of all respondents so the total N would again be 189.

In the first question we see that the majority of respondents disagree that the best way to learn what is going on is to rely on leaders or experts. It would seem

from this that our respondents trust their ability to make decisions and form opinions.

In the second question, the majority of people either are neutral or agree that they tend to get angry when other people refuse to admit that they are wrong. This would be

TABLE 5.10

ADJUSTED FREQUENCIES OF RESPONSES TO DOGMATISM QUESTIONS

	DISAGREE		NEUTRAL	AGREE		TOTAL
RELY ON LEADERS:In this complicated world or ours, the only way to know what is going on is to rely on leaders who can be trusted.....	32.6	25.5	12.5	20.1	9.2	99.9% (N=184)
GET ANGRY:I get really angry when a person stubbornly refuses to admit that they are wrong.....	11.0	10.4	28.0	28.0	22.5	99.9% (N=182)
TWO TYPES:There are two kinds of people in this world: those who are for the truth and those who are against it.....	47.8	20.2	14.6	10.1	7.3	100.0% (N=178)
ONE PHILOSOPHY:Of all the different philosophies which exist in the world, there is probably only one which is correct.....	72.4	13.8	9.9	0.6	3.3	100.0% (N=181)

an indicator of dogmatism based on earlier studies. In contrast, for the third and fourth question we find that the majority of respondents are answering in what would ap-

pear to be a non-dogmatic manner.

As with the earlier sets of questions, we decided to create one new variable for subsequent analysis. In an SPSS factor analysis all of the variables loaded onto one factor. Thus, we decided that it was legitimate to simply add them up to create a variable which we will call DOGMATISM. People who rank high on this variable will more dogmatic. Those who rank low will be less more open and should be more receptive to new information and more likely to adopt innovations.

Summary

We began this chapter with a discussion of the sample design and then proceeded to a presentation of the construction of the questionnaire. Out of the questionnaire we have developed a few groups of variables that fit into the model developed in Chapter 4: situational variables; decision factors (including price, information and norms); and individual characteristics (attitudinal variables; values, overall knowledge, and dogmatism).

Up to this point we have only looked at how the responses to these variables are distributed among all of the participants in the survey. Drawing on LaBay and Kinnear, however, we recognize that we must examine the differences among those who adopt various types of energy systems. In the next chapter we shall begin to look for any

between group differences and then see how well our model helps to explain the adoption of alternative energy systems.

CHAPTER 6

BETWEEN-GROUP DIFFERENCES

Introduction

In Chapter 5 we looked at how the theoretical issues which we had elaborated upon in the previous chapters have been operationalized for this dissertation. In this chapter we will conduct one way analysis of variance to look for differences between the groups for each of our dependent variables: centralized versus decentralized adopters; solar non-adopters versus solar adopters; wood non-adopters versus wood adopters; non-adopters versus all adopters; unaware adopters versus solar adopters;, and, finally, unaware non-adopters versus wood adopters. This should help to inform our discussion in the next chapter in which we will employ logit analysis to decide which variables to include in a model which will best predict our various dependent variables. Let us turn now to the comparisons for each of our groups of independent variables.

Centralized v. Decentralized Adopters

Situational Variables

In Table 6.1 we see first the breakdown of our demographic variables. Using a straight-forward analysis of

TABLE 6.1

MEAN, STANDARD DEVIATION AND SIGNIFICANCE LEVEL
BY CENTRALIZED/DECENTRALIZED ADOPTER

	Centralized		Decentralized		P-value	
	Mean	StDev	Mean	StDev	ANOVA	K-W
SITUATIONAL VARIABLES						
Age	51.62	13.52	46.89	1.99	.044	.054
Sex	.27		.24		.780	.778
Marital Status	.16		.13		.743	.742
Duncan SEI	61.57	16.73	60.55	19.38	.792	.920
Family Income	7.25	2.18	6.61	2.27	.136	.096
Education	13.91	1.10	13.86	1.31	.817	.924
Year Purchased	69.56	10.51	74.48	7.40	.003	.007
House Age	38.62	46.04	34.17	53.86	.640	.018
House Size	7.62	2.50	6.97	1.74	.084	.177
DECISION FACTORS						
Initial Cost	3.62	1.09	3.75	1.22	.551	.424
Long-term Savings	3.62	1.29	4.70	.58	.000	.000
Tax Credits	3.08	.65	3.19	.94	.537	.289
TOTAL EXPOSURE	2.82	1.32	3.23	1.14	.072	.058
Relative Owned One	3.34	.73	3.60	.84	.117	.092
Owned One Before	2.62	.99	2.73	.82	.529	.760
Relative's Advice	3.31	.68	3.57	.85	.118	.106
Salesperson's Advice	3.29	.70	3.13	.47	.188	.128
Engineer's Advice	3.44	.77	3.32	.63	.350	.342
Builder's Advice	3.53	.83	3.31	.71	.160	.169
Demonstration Home	3.12	.41	3.14	.53	.819	.683
Newspapers	3.28	.58	3.74	.82	.005	.001
INDIVIDUAL CHARACTERISTICS						
Science Helps	2.73	1.04	2.23	1.26	.049	.013
Can't Meet Ends	2.40	1.42	2.59	1.47	.505	.578
Use As Affordable	2.74	1.54	1.95	1.33	.003	.005
Raise Taxes	1.74	.98	2.22	1.27	.035	.051
Shortage Inevitable	3.37	1.28	3.92	1.05	.014	.023
PLENTY	3.23	1.61	3.17	1.37	.829	.926
NOSOLAR	8.77	3.34	7.34	3.34	.037	.021
NONUKES	5.07	3.27	6.68	3.02	.008	.004
TOOTECHY	8.81	2.93	8.55	2.22	.623	.556
Independence	3.34	.91	4.78	.48	.000	.000
Clean Energy	4.28	.85	3.47	1.29	.001	.002
Innovative Tech	3.50	.71	3.42	.83	.608	.598
DOGMATIC	10.20	3.21	9.15	2.97	.001	.096
KNOWLEDGE	1.58	.94	2.05	.95	.009	.006

variance, two of these variables show significant differences between the means -- Age and Year Purchased. House Size, however, had a highly skewed distribution. Because this could be characteristic of many of our variables, we have also conducted a Kruskall Wallis test for differences between the groups. The Kruskall Wallis test compensates for the skewed nature of the distribution because it is based on the median rather than the mean. The results of this test (reported in the last column), demonstrate that House Size is also significant. We will discuss each of these in turn.

The age of the centralized adopters is nearly 5 years higher on average than that of the decentralized adopters. This is to a certain extent understandable. Adopters of all innovations generally tend to be younger than those who continue to use traditional technologies. But here we would expect it to be the case because the older respondents would have been more likely to purchase their homes prior to the era when knowledge and information about alternative systems was widely available.

This seems to be borne out by the fact that the other significant variable is the year in which the house is purchased. The homes of the centralized adopters tend to have been purchased about 5 years earlier than the homes of the decentralized adopters. We would also expect, then, for the age of the homes with centralized systems to be greater than the age of decentralized homes. Such is the case here, but

the difference does not appear to be significant. Finally with respect to the final housing characteristic,the size of the homes with decentralized systems is slightly smaller than those with centralized energy systems.

One would not expect there to be significant differences between these two groups in terms of their sex or their marital status. But the fact that there is no difference in education seems somewhat surprising. The problem may arise from two different points. One, it is the wood adopters who dominate this decentralized category. Perhaps women are less inclined to use wood because of the effort involved. The other is the fact that both groups are actually adopters, just of different types of systems, so perhaps we should not expect there to be as much difference between them as between adopters and nonadopters.

Decision Factors

Price Considerations. In this section we find that there is only one variable which demonstrates significant differences between the means. From the price-related variables we find that only the possibility of long-term savings was significantly different for these two groups. It had a much more positive impact for the group that adopted the decentralized alternative. It is surprising that the initial cost was not a stronger deterrent for the decentralized adopters. Perhaps this, too, is a product of the wood adop-

ters' domination of this category. Tax credits appears to be neutral for both groups, as we would expect based on the results of other studies mentioned in the last chapter.

Normative Exposure and Habit. We might very well expect that the people who have adopted decentralized alternatives are more likely to have seen such systems in operation than those who adopt the centralized alternatives. This is not borne out in this data, however. While there is a slight difference, with decentralized adopters stating that they knew more people who had decentralized systems, this difference is not significant using either of our tests. On the other hand, the Kruskall Wallis test is very close to showing a significant difference.

The fact that relatives may have owned a system similar to the one which the respondent purchased seems to have played no role here. For both groups, the impact was neutral and there was no difference between them. Similarly, the fact that there the respondent had owned the same type of system which was subsequently purchased shows no significant differences. It was odd, though, that for both sets of respondents, this variable had a negative affect on their decision. Only .8% of our respondents answered in this manner, but apparently those few people who answered that it was a very discouraging factor in their decision was enough to bring down the mean. These respondents who were discouraged but purchased a system again in spite of this

may have simply perceived no alternative.

Information. Among the information variables, we find that information from primary reference groups (relatives advice) fails to show any difference between these two groups. And from among the secondary information variables, the only significant difference is for newspapers. Here we find that the information was more positive for the decentralized adopters. This is not the sort of result we would have expected given the earlier assumption that information networks are primarily controlled by those who wish to perpetuate centralized alternatives. It may be that since the original category was newspapers or magazines, what people have done is seek out magazines that deal with non-traditional alternatives prior to making their decision.

Individual Characteristics

Attitudes. Recall that in the previous chapter we developed new variables based on a factor analysis of the attitude variables used in the survey. Here we will employ those new variables (which we will designate by using capital letters) as well as the other attitude variables which were not included in the scales. We will not discuss the differences between the means for the individual variables included in each of the scales since they are not going to be used in our analyses on a separate basis. That leaves us

with 5 remaining variables and 4 attitude scales.

We see, first, that those who have adopted the centralized alternatives are more likely to believe that science will be able to solve our energy problems. This would seem to tie in well with their greater trust in nuclear power, since we see that they are less likely to argue that it is dangerous or that it should be stopped immediately. On the other hand, while they like science, they do not think that science in the form of solar power offers much of a solution. Here we see that they are more likely than the decentralized adopters to be against solar alternatives. Finally, as we would expect, those who believe that science will solve our problems and that nuclear power is a solution are also less likely to think that another energy shortage is inevitable.

Turning to the other variables that have significant differences, we see that the centralized adopters are more inclined to agree that people should be able to use as much energy as they can afford. They are also against raising taxes in order to encourage conservation.

The other variables do not show significant differences. It is a little uprising in a few of these cases since so much of the literature seems to present an opposite viewpoint on these attitudes. For example, the only variable to measure felt personal impact (Can't Meet Ends) does not show a significant difference. Perhaps this was too strong a statement since most people tended to disagree.

respondents has more to do with the cleanliness of the system at the point of use rather than a larger environmental concern, since that would seem to be what the responses dictate.

Knowledge and Dogmatism. Finally, the centralized adopters seem to know less about energy issues in general. They score significantly lower on the knowledge variable than do the decentralized adopters. They also tend to be more dogmatic although this latter variable is not significant at the .05 level.

Solar Nonadopters versus Solar Adopters

Situational Variables

In Table 6.2 we find that House Age and Year Purchased show significant differences if we account for the fact that they have skewed distributions by using the Kruskall Wallis statistic. The fact that solar homes tend to be much younger is not at all surprising. However, we find little difference between adopters and non-adopters on other demographic variables. This is probably due to the fact that while solar adopters may not be the same as the general population, those who consider it at all in the first place tend to have similar characteristics.

TABLE 6.2

MEAN, STANDARD DEVIATION AND SIGNIFICANCE LEVELS
BY AWARE SOLAR NONADOPTERS/SOLAR ADOPTERS

	Solar NonAdopters		Solar Adopters		P-value	
	Mean	StDev	Mean	StDev	ANOVA	K-W
SITUATIONAL VARIABLES						
Age	47.92	12.54	48.29	15.02	.916	.931
Sex	.31		.29		.915	.914
Marital Status	.09		.24		.111	.111
Duncan SEI	60.53	20.19	60.69	24.28	.981	.842
Family Income	7.31	2.09	6.25	2.38	.084	.080
Education	13.98	1.34	13.82	1.63	.675	.946
Year Purchased	73.77	7.82	76.29	10.20	.270	.017
House Age	38.99	49.77	8.59	10.27	.015	.000
House Size	7.43	1.87	6.88	1.54	.275	.228
DECISION FACTORS						
Initial Cost	1.57	.90	3.25	1.29	.000	.000
Long-term Savings	3.47	1.24	4.75	.58	.000	.000
Tax Credits	3.55	1.03	3.81	1.05	.367	.396
TOTAL EXPOSURE	3.02	1.18	3.63	1.19	.060	.062
Relative Owned One	3.19	.52	3.53	.74	.046	.048
Owned One Before	3.00	.00	3.24	.56	.003	.002
Salesperson's Advice	3.01	.54	3.13	.35	.439	.335
Relative's Advice	3.17	.47	3.60	.63	.006	.002
Engineer's Advice	2.96	.44	4.06	.77	.000	.000
Builder's Advice	2.92	.33	3.86	1.03	.000	.000
Demonstration Home	3.24	.69	3.53	.74	.159	.221
Newspapers	3.54	1.07	4.07	.80	.082	.068
INDIVIDUAL CHARACTERISTICS						
Science Helps	2.19	.95	2.25	1.53	.855	.606
Can't Meet Ends	2.62	1.43	1.71	1.21	.019	.014
Use As Affordable	2.33	1.53	1.41	.71	.019	.031
Raise Taxes	2.25	1.31	2.41	1.37	.655	.655
Shortage Inevitable	3.71	1.06	4.00	1.28	.342	.173
PLENTY	3.03	1.59	3.50	1.36	.286	.065
NOSOLAR	8.14	3.52	6.24	3.35	.051	.015
NONUKES	6.66	2.98	6.38	3.14	.739	.869
TOOTECHY	8.09	2.17	8.06	2.22	.951	.927
Independence	4.16	1.00	4.82	.39	.010	.005
Clean Energy	4.28	.79	4.63	.81	.132	.052
Innovative Tech	3.75	1.16	4.07	.70	.314	.484
DOGMATIC	8.91	2.44	9.93	3.75	.203	.400
KNOWLEDGE	2.09	.86	2.18	.81	.724	.795

Decision Factors

Price Considerations. Initial cost and long-term savings were both more discouraging for those who at first considered solar power and then decided not to adopt. The difference for initial cost is especially large, and would seem to be playing a major role in people's decisions.

Normative Exposure and Habit. There is very little difference between these groups with regard to how many people they know who have such systems. This is not surprising since they would tend to know other solar owners prior to even considering such a purchase.

There are significant differences however for our other two variables in this category. The fact that relatives had owned a similar system had a more positive impact on adopters of solar alternatives. Similarly, having owned one before plays a positive role in the decisions of people who choose to adopt. We would not expect many people to have owned such a system before, because they are so rare. Certainly this is the case with the non-adopters. However, some of the owners state that they had owned a solar system before and the experience had a positive impact on their decision to purchase a new system.

Information. Here we find that the advice of both primary reference groups (relatives) and secondary reference groups (engineers and builders) has tended to discourage

people who decided against purchasing solar equipment and acted to encourage those who did adopt such systems. It would be interesting to be able to determine to whom these people had actually turned for advice. Certainly if this is characteristic of the entire population, then solar purchases could be greatly enhance through the additional support of these categories of people.

Individual Characteristics

Since there are so few differences here, we shall discuss all of them together. It is not surprising that there are so few differences between the groups, since we would expect that anyone open to solar power would have similar backgrounds and attitudes. Solar adopters are, however, much less likely than solar non-adopters to agree that people should be able to use as much energy as they can afford. There is also a difference with regard to their attitude toward solar power. Those who have adopted solar systems tend to be more likely to say that solar has a future (i.e., they score lower on the NOSOLAR scale). This should be expected given the advice they have received from people. The adopters are more likely to be pro-solar, but the difference is not significant at the .05 level. Finally, with regard to values, the solar adopters are more likely to say that independence played an positive role in their decision and that clean energy was also important for them.

Wood Nonadopters versus Wood Adopters

Situational Variables

This was our largest category of adopters. We see in Table 6.3 that the only significant difference between these groups is on the variable House Age. Older homes are, of course, more difficult to retrofit than newer ones, so this could explain most of the difference. None of the other demographic variables showed any significant differences. This is probably to be expected. Many people from all walks of life have adopted wood, it is accessible to people in any income group, and houses of any age or size can be retrofitted to accommodate wood. To explore the differences here, we must turn to our other categories.

Decision Factors

Price Considerations. As in our other comparisons, both initial cost and long-term savings had a more positive influence on adopters than on non-adopters. In fact, both were discouraging factors for non-adopters. This fact is difficult to understand since wood is so often seen as requiring very little investment and having a very fast payback period. Oddly enough, the availability of tax credits plays the opposite role. Perhaps those who have actually adopted found the tax credits to be smaller than they

TABLE 6.3

MEAN, STANDARD DEVIATION AND SIGNIFICANCE LEVEL
BY AWARE WOOD NONADOPTERS/WOOD ADOPTERS

	Wood Nonadopters		Wood Adopters		P-value	
	Mean	StDev	Mean	StDev	ANOVA	K-W
SITUATIONAL VARIABLES						
Age	46.30	13.61	47.18	11.43	.760	.629
Sex	.30		.22		.403	.399
Marital Status	.17		.10		.359	.356
Duncan SEI	59.33	18.98	59.93	18.63	.908	1.000
Family Income	6.18	2.54	6.71	2.20	.356	.426
Education	13.27	1.64	13.86	1.25	.081	.105
Year Purchased	72.00	8.22	73.97	6.58	.254	.341
House Age	44.30	38.31	39.11	57.17	.686	.020
House Size	7.22	2.17	7.03	1.77	.676	.949
DECISION FACTORS						
Initial Cost	2.25	1.02	3.83	1.21	.000	.000
Long-term Savings	2.72	1.32	4.69	.58	.000	.000
Tax Credits	3.24	.75	3.02	.83	.323	.233
TOTAL EXPOSURE	2.15	1.09	3.14	1.09	.000	.000
Relative Owned One	3.31	1.02	3.59	.86	.265	.525
Owned One Before	2.87	.35	3.46	.78	.006	.003
Salesperson's Advice	3.25	.78	3.12	.48	.412	.472
Relative's Advice	3.25	.86	3.57	.88	.369	.511
Engineer's Advice	2.80	.56	3.17	.48	.012	.012
Builder's Advice	2.93	.26	3.21	.57	.068	.051
Demonstration Home	3.00	.38	3.06	.43	.613	.511
Newspapers	3.07	.88	3.69	.81	.011	.014
INDIVIDUAL CHARACTERISTICS						
Science Helps	2.89	1.37	2.17	1.37	.029	.040
Can't Meet Ends	3.09	1.45	2.77	1.45	.370	.335
Use As Affordable	2.55	1.60	2.06	1.40	.175	.202
Raise Taxes	1.67	1.02	2.14	1.23	.110	.095
Shortage Inevitable	3.24	1.18	3.90	1.00	.014	.016
PLENTY	4.00	2.09	3.09	1.34	.029	.083
NOSOLAR	8.89	3.25	7.70	3.39	.179	.111
NONUKES	6.35	3.28	6.67	3.02	.686	.692
TOOTECHY	9.47	2.64	8.67	2.19	.229	.152
Independence	3.50	.86	4.76	.50	.000	.000
Clean Energy	2.40	1.06	3.20	1.23	.023	.030
Innovative Tech	2.87	.92	3.29	.79	.070	.191
DOGMATIC	11.65	2.94	9.07	2.85	.001	.001
KNOWLEDGE	1.50	.80	2.04	.99	.022	.010

were originally perceived.

Normative Exposure and Habit. Wood adopters know more people who are using wood than do the non-adopters. They are also more likely to say that having owned one before had a positive impact on their decision to purchase this time around.

Information. Only three of these variables show any significant differences. Again, engineer's advice plays a role in people's decision, but this time it is a positive role, although not strongly positive on average. Builders also prove to be more supportive of wood as an alternative. In addition, newspapers tend to have a more positive impact on adopters' decisions than they did for non-adopters.

Individual Characteristics

Attitudes. We see here that three of our attitude variables show significant differences. The first of these is Science Helps. Wood users are significantly less likely to think that science will provide solutions to our problems. They are also more likely to think that a shortage in inevitable and less inclined to believe that we still have plenty of oil. Other attitudes, regarding solar power and nuclear power, tend to be about the same for both groups.

Values. Once again, both Independence and Clean Energy show significant differences. As in other cases, the desire to be independent was a much more positive factor for adopters than for non-adopters. In addition, in this comparison, a desire for clean energy discouraged the non-adopters. In other words, nonadopters tend to see this as not a very clean source of energy, and they are discouraged on that account.

Dogmatism and Knowledge. The people who thought about wood and then decided against such a purchase have a much higher score on the dogmatism scale than do the adopters. In fact, this group has the highest score of the entire set of comparisons we have made. Perhaps this is due to the fact that so many people have considered wood. Thus, the score is more indicative of the degree of dogmatism in the survey respondents as a whole. Finally, those who adopted wood demonstrate much more knowledge about energy than the non-adopters.

Unaware Nonadopters versus All Adopters

Beginning with Table 6.4, we will only be able to make comparisons based on the responses to our demographic variables and respondents individual characteristics (not including values). Since the questionnaire only allowed people to state the role that decision factors and values

TABLE 6.4

MEAN, STANDARD DEVIATION AND SIGNIFICANCE LEVELS FOR ALL NON-ADOPTERS/ALL ADOPTERS

	Nonadopters		All Adopters		P-value	
	Mean	StDev	Mean	StDev	ANOVA	K-W
SITUATIONAL VARIABLES						
Age	48.26	14.29	48.57	12.71	.883	.589
Sex	.43		.25		.015	.016
Marital Status	.20		.14		.338	.336
Duncan SEI	58.55	22.57	60.90	18.42	.493	.806
Family Income	6.38	2.49	6.85	2.25	.209	.160
Education	13.58	1.53	13.87	1.23	.167	.284
Year Purchased	73.23	7.24	72.73	8.91	.704	.877
House Age	47.80	47.13	35.73	51.10	.122	.000
House Size	7.41	1.76	7.20	2.06	.488	.352
INDIVIDUAL CHARACTERISTICS						
Science Helps	2.41	1.17	2.38	1.21	.870	.790
Can't Meet Ends	2.58	1.42	2.53	1.45	.805	.737
Use As Affordable	2.28	1.47	2.23	1.45	.802	.751
Raise Taxes	2.25	1.33	2.06	1.20	.337	.451
Shortage Inevitable	3.61	1.06	3.75	1.16	.470	.308
PLENTY	3.73	2.00	3.19	1.45	.053	.160
NOSOLAR	8.51	3.53	7.79	3.39	.203	.206
NONUKES	6.43	3.16	6.14	3.18	.573	.591
TOOTECHY	8.51	2.08	8.63	2.44	.794	.785
DOGMATIC	9.41	3.33	9.51	3.08	.843	.673
KNOWLEDGE	1.92	.70	1.88	.97	.804	.907
TOTAL EXPOSURE	2.26	1.18	3.09	1.22	.000	.000

played in their adoption decisions, then since they had not even thought about adopting, the unaware non-adopters, by definition, have no responses to these variables. Since there are so few significant variables to discuss, we will simply discuss everything at once.

In Table 6.4 we see that Sex and House Age are the only situational variables to show a significant difference between the groups. Non-adopters are much more likely to be

women. We might attribute this to the fact that women who live alone may be less likely to devote the energy to the installation of a new system. But there is no significant difference between the groups in terms of marital status or any other category that would help us to understand this difference. It could only be attributed to the fact that in families where the woman is more likely to respond to the questionnaire, some other factor is also at work. As in the past, the homes of nonadopters tend to be older.

The only other variable to show significant differences is Total Exposure. Here we see that the adopters know more people who have decentralized systems. Recall that this is all adopters, both centralized and decentralized. We need to look next at a more detailed breakdown.

Unaware Nonadopters versus Solar Adopters

In Table 6.5 we should first note that the age of the homes of solar adopters is again much less than the age of homes for unaware non-adopters. This is not surprising given that the solar technology is a relatively new innovation, so older homes will not be likely to have it incorporated into their design. We see no other differences in the situational variables. Even the difference in the sex of respondents has disappeared.

Of the remaining variables, two now show significant differences. As we might expect, the solar adopters are

TABLE 6.5

MEAN, STANDARD DEVIATION AND SIGNIFICANCE LEVELS
FOR UNAWARE NON-ADOPTERS/SOLAR ADOPTERS

	Nonadopters		Solar Adopters		P-value	
	Mean	StDev	Mean	StDev	ANOVA	K-W
SITUATIONAL VARIABLES						
Age	50.21	15.74	48.29	15.02	.698	.643
Sex	.42		.29		.435	.428
Marital Status	.25		.24		.917	.915
Duncan SEI	56.50	24.23	60.69	24.28	.638	.748
Family Income	6.08	2.36	6.25	2.38	.828	.759
Education	13.91	1.16	13.82	1.63	.840	.816
Year Purchased	72.50	7.58	76.29	10.20	.179	.028
House Age	33.38	27.67	8.59	10.27	.001	.000
House Size	6.71	1.57	6.88	1.54	.743	.828
INDIVIDUAL CHARACTERISTICS						
Science Helps	2.06	.90	2.25	1.53	.662	.880
Can't Meet Ends	2.09	1.20	1.71	1.21	.329	.265
Use As Affordable	2.08	1.31	1.41	.71	.062	.074
Raise Taxes	2.45	1.41	2.41	1.37	.925	.930
Shortage Inevitable	4.00	.76	4.00	1.28	1.000	.446
PLENTY	3.75	2.12	3.50	1.37	.686	.869
NOSOLAR	8.50	3.73	6.24	3.35	.057	.009
NONUKES	5.81	3.47	6.38	3.14	.612	.462
TOOTECHY	8.38	2.25	8.06	2.22	.687	.839
DOGMATIC	8.09	3.06	9.93	3.75	.109	.086
KNOWLEDGE	1.96	.75	2.18	.81	.380	.382
TOTAL EXPOSURE	2.30	1.18	3.64	1.19	.001	.002

more likely to be pro-solar. They are less likely to think that solar technology is too difficult or that it will soon be replaced. Finally, they also know more people with decentralized systems. Finally, those people who have adopted solar know more people who have also purchased such system.

According to our Kruskall Wallis test, two other variables -- Use as Affordable and Dogmatic -- tend to show some

difference, but it is not significant at the .05 level. As might be expected, solar adopters are less likely to think that people should be able to use as much energy as they can afford. They also tend to be more dogmatic, a result which is highly unexpected according to our earlier theoretical discussions. We should pay attention to these in our logit analysis.

Unaware Nonadopters versus Wood Adopters

In our last table of between group comparisons, Table 6.6, we see that wood adopters are much more likely to be men, although this is not really significant. This might be due to the fact that women find wood use to be too labor-intensive, but they are no more likely to be single than the unaware group. Of course, the fact that the wood adopters make up most of the decentralized category explains why the difference occurred in our earlier comparison between those adopters and the unaware non-adopters.

In the other categories, we find that there is only one significant difference. Once again, wood adopters are much more likely to know people who have purchased decentralized systems than are the unaware nonadopters.

TABLE 6.6

MEAN, STANDARD DEVIATION AND SIGNIFICANCE LEVELS FOR UNAWARE NON-ADOPTERS/WOOD ADOPTERS

	Nonadopters		Wood Adopters		P-value	
	Mean	StDev	Mean	StDev	ANOVA	K-W
SITUATIONAL VARIABLES						
Age	50.21	15.74	47.19	11.43	.317	.735
Sex	.42		.22		.059	.059
Marital Status	.25		.10		.072	.072
Duncan SEI	56.50	24.23	59.93	18.48	.530	.622
Family Income	6.08	2.36	6.71	2.20	.249	.229
Education	13.91	1.16	13.86	1.25	.851	.933
Year Purchased	72.50	7.58	73.97	6.58	.367	.463
House Age	33.37	27.66	39.11	57.17	.638	.090
House Size	6.72	1.57	7.03	1.77	.434	.436
INDIVIDUAL CHARACTERISTICS						
Science Helps	2.06	.90	2.17	1.18	.727	.966
Can't Meet Ends	2.08	1.20	2.77	1.46	.045	.050
Use As Affordable	2.08	1.31	2.06	1.40	.933	.675
Raise Taxes	2.46	1.40	2.14	1.23	.319	.384
Shortage Inevitable	4.00	.76	3.90	1.00	.655	.890
PLENTY	3.75	2.12	3.09	1.34	.102	.313
NOSOLAR	8.50	3.72	7.70	3.39	.357	.452
NONUKES	5.81	3.47	6.67	3.02	.274	.259
TOOTECHY	8.37	2.25	8.67	2.19	.639	.777
DOGMATIC	8.09	3.06	9.08	2.85	.165	.063
KNOWLEDGE	1.95	.75	2.04	.99	.702	.420
TOTAL EXPOSURE	2.30	1.18	3.14	1.09	.002	.002

Summary and Discussion

Table 6.7 gives a brief summary of which variables have proven to be significant in all of our comparisons to this point. The asterisk represents simply that the variable was significant without regard to the level of significance.

There are two ways of looking at this table. One is to

Table 6.7
Summary of Significant Variables

	Comparison					
	6.1	6.2	6.3	6.4	6.5	6.6
SITUATIONAL VARIABLES						
Age	*					
Sex				*		
Marital Status						
Duncan SEI						
Family Income						
Education						
Year Purchased	*	*			*	
House Age	*	*	*	*	*	
House Size						
DECISION FACTORS						
Initial Cost		*	*			
Long-term Savings	*	*	*			
Tax Credits						
TOTAL EXPOSURE			*	*	*	*
Relative Owned One		*				
Owned One Before		*	*			
Salesperson's Adv						
Relative's Advice		*				
Engineer's Advice		*	*			
Builder's Advice		*	*			
Demonstration Home						
Newspapers	*		*			
INDIVIDUAL CHARACTERISTICS						
Science Helps	*		*			
Can't Meet Ends		*				*
Use As Affordable	*	*				
Raise Taxes	*					
Shortage Inevitable	*		*			
PLENTY						
NOSOLAR	*	*			*	
NONUKES	*					
TOOTECHY						
Independence	*	*	*			
Clean Energy	*	*	*			
Innovative Tech						
DOGMATIC	*		*			
KNOWLEDGE	*		*			

examine each comparison to see which variables show signifi-cant differences between the groups. Rather than simply reiterating that earlier discussion, however, we can also begin to examine which variables seem to be most consistent-ly involved across comparisons.

The first item that stands out is the fact that there are quite a few variables which are involved in most of the comparisons between different adopters or between aware non-adopters and adopters. One of the value variables -- Inde-pendence -- shows up in all three of these comparisons, and Clean Energy is significant in two an has a Kruskall Wallis of .052 in the third, and these were the only three com-parisons in which these variables were included. Savings and House Age also show up in all three of these com-parisons. A number of other variables show up in two of the first three comparisons: Year Purchased, Initial Cost, Owned One Before, the advice of builders and engineers, Science Helps, Use as Affordable, Shortage Inevitable, NOSOLAR, DOGMATIC, and KNOWLEDGE.

On the other hand, if we look at the comparisons be-tween adopters and nonadopters or unaware nonadopters, the only variable that seems to stand out is TOTAL EXPOSURE. Of course, that finding is important, since it means that the very first step, the one which must be included before the other variable come into play, is that people be aware of the alternatives.

This seems to demonstrate that the our theoretical for-

mulations have sensitized us to a wide variety of variables, many of which should help us to understand the process of adoption. On the other hand, we could also begin to conclude that the demographic considerations do not really help us to understand this phenomenon. But to answer that question we need to turn to our Logit analysis.

CHAPTER 7

LOGIT ANALYSIS

Introduction

There are a variety of strategies that can be followed in this analysis. Here we shall choose to combine two different approaches. First, we shall compare the different groups of variables which we have been using to see which of these sets best help us to understand the difference between the groups in our various comparisons. Here we are limited by the size of our sample. In running our logit analyses, we will eliminate cases that have missing data on any of the included variables. In order to retain enough cases for meaningful comparisons, we will include only variables that have significant bivariate effects, as seen in Chapter 6. Although different variables will be used in each of our logit analyses, we can still examine the effects of the major groups of variables (situational variables, decision variables, and individual characteristics) by comparing the chi square statistics for all of the relevant variables in each of these major groups.

Following this comparison between the major subgroups of variables, we will take those variables which show significant t statistics in these analyses and employ them in a second analysis where we will decide which collection of

variables gives us the best model. Here we have entered into the logit analysis all of the variables which had significant t's in our first set of analyses. Subsequently, we remove, one by one, the variables with the smallest t's until we end up with a model where all of the remaining variables are significant at α=.1 or until the withdrawal of a variable makes a significant difference in our chi square.

Centralized Versus Decentralized Adopters

Table 7.1 shows the log likelihood, the chi square and the significance of the chi square for each category of variables when we run a logit with our centralized/decentralized dependent variable. The first comparison we will make is between these major sets of variables.

Here it is readily apparent that the largest chi square, and the best set of predictors is the set of individual characteristics which we have identified. Recall that in this analysis, we are using only the individual characteristics which demonstrated significant differences between the means (Science Helps, Use as Affordable, Raise Taxes, Shortage Inevitable, Nosolar, Nonukes, Independence, Clean Energy, Dogmatic, and Knowledge). The chi square for our decision variables (Long-term savings and Newspapers) is also significant. The situational variables (Age, Year Purchases, and House Age) have little predictive value.

Table 7.1

SUMMARY OF SEPARATE LOGIT ANALYSeS FOR
CENTRALIZED/DECENTRALIZED ADOPTERS

	Log Likelihood	Chi Sq	Sig
SITUATIONAL VARIABLES.....	-40.0989	2.46	.4818
DECISION FACTORS.....	-32.8778	16.91	.0002
INDIVIDUAL CHARACTERISTICS..	-12.4176	57.83	.0000

Table 7.2

FINAL LOGIT MODEL FOR
CENTRALIZED/DECENTRALIZED ADOPTERS

Logit Estimates — Number of obs = 75
chi2(2) = 51.50
Log Likelihood =-15.579776 — Prob > chi2 = 0.0000

Variable	Coefficient	Std. Error	t	Prob>|t|
Independence	3.24327	.802566	4.041	0.000
Use as Afford	-.68847	.343538	-2.004	0.049
constant	-10.64244	3.100618	-3.432	0.001

We can also examine these major groups of variables to see whether or not the addition of either of the other subsets to the Individual Characteristics yields a significant increase in our chi square. If we test a model which includes the Decision Factors with the Individual Characteristics, we obtain an increase in our chi square of only 3.35 with 2 degrees of freedom, an insignificant increase. The addition of the Situational Variables yields a similarly insignificant increase (2.10 with 3 degrees of freedom). Thus, we find that the Individual Characteristics are the best predictors.

This is further supported by our second analysis. Here we have taken only those variables from the earlier analysis which demonstrated a significant bivariate relationship with adoption. This included Independence, Use as Affordable, and Long-term Savings. Since Savings was unrelated to adoption, we dropped it from our model; the decrease in Chi-square was insignificant (1.54 with 1 degree of freedom). Table 7.2 presents this final model for centralized/ decentralized adopters. The final model includes only individual characteristics -- Independence and Use as Affordable (Log Odds of Decentralized Adoption = -10.642 + 3.243 Independence - .685 Use as Afford).

Most of the predictive power of this model comes from the Independence. As the desire to be independent increases, so does the likelihood that the respondent will have purchased a decentralized energy system. In addition, people who believe that we should be able to use as much energy as we can afford are less likely to be decentralized adopters.

The chi square statistic tells us two things. First, the coefficients in this model are significantly different from 0. In addition, we know that this model is also better than the model which included Long-term savings, because the addition of that variable did not signicantly increase the chi square. This supports our earlier theoretical reasoning. It is a bit surprising that none of the decision factors showed up in this final model since we

postulated earlier that price factors would play some role. The fact that Independence is a better predictor than the other variables lends additional support to our hypothesis that price considerations, while important, play only a limited role in the adoption of alternative energy systems.

Solar Nonadopters versus Solar Adopters

Here we can make a more specific comparison. One of our criticisms of earlier studies has been that it is in

Table 7.3

SUMMARY OF SEPARATE LOGIT ANALYSES FOR AWARE SOLAR NONADOPTERS/SOLAR ADOPTERS

	Log Likelihood	Chi Sq	Sig
SITUATIONAL VARIABLES.....	-25.9034	6.82	.0330
DECISION FACTORS.....	- 9.2023	40.23	.0000
INDIVIDUAL CHARACTERISTICS..	-21.6567	15.32	.0091

Table 7.4

FINAL LOGIT MODEL FOR AWARE SOLAR NONADOPTERS/SOLAR ADOPTERS

Logit Estimates — Number of obs = 54
chi2(3) = 46.67
Log Likelihood =-9.4818925 — Prob > chi2 = 0.0000

Variable	Coefficient	Std. Error	t	Prob>|t|
Initial Cost	1.03403	.442859	2.335	0.024
Engin. Advice	4.70863	2.145872	2.194	0.033
Meet Ends	-1.61845	.888578	-1.821	0.075
constant	-15.65406	6.178139	-2.534	0.014

appropriate to compare the general population with adopters. If we hope to discover what discourages people, we need to look more closely at those who have considered adoption.

Table 7.3 shows us that in this case the Decision Factors are the best predictors. In contrast to the first logit analysis, we note here that both of the other groups of variables have significant chi squares, with that of the Individual Charactersitics being the larger.

If we add the five variables from our Individual Characteristics (see Table 6.7), we get an increase of only 7.94 in our chi square, which is not significant given the five degrees of freedom. Similarly, the Situational Variables are also insignficant. Thus, only the Decision Factors have clearly nonzero effects.

There were only three significant variables in these individual comparisons: Initial cost, Engineer's advice, and Can't Meet Ends. As it turns out, all of these had P-values below .1 (Table 7.4). Thus, our final model is Log Odds of Solar Adoption = -15.654 + 1.034 Initial Cost + 4.709 Engineer's Advice - 1.619 Can't Meet Ends. The variable which stands out the most here is the advice of engineers. When their advice is deemed more positive, respondents are more likely to fall into the adopters category. In Chapter 6 we saw that the nonadopters tended to find engineer's advice discouraging, but now we see that as their advice becomes more positive, people are more

likely to adopt.

The next most important variable is the belief that energy prices make it difficult to make ends meet which has a negative effect. Thus, as these attitudes increase, individuals are less likely to adopt decentralized systems. Initial cost, our last variable, is positively related to adoption. Those respondents who have adopted a decentralized system are more likely to say that the initial cost had a positive impact on their decision.

In this particular model, we end up including all of the variables which had a significant bivariate relationship with solar adoption because each one has a P-value below .1. Thus, we will not test alternative models.

Wood Nonadopters versus Wood Adopters

In Table 7.5 we see that the chi square for the situational variables is not significant. We cannot reject the null hypothesis that these variables are unrelated. On the other hand, the chi square for the decision variables is much higher and significant. But the highest chi square is associated with the Individual Characteristics. If we add either of the other sets of variables to the Individual Characteristics, we get an insignificant increase in our chi square.

The analysis of the three individual variables which had P-values below .1 -- Long-term savings, Knowledge, and

Table 7.5

SUMMARY OF SEPARATE LOGIT ANALYSES FOR
AWARE WOOD NONADOPTERS/WOOD ADOPTERS

	Log Likelihood	Chi Sq	Sig
SITUATIONAL VARIABLES.....	-14.0942	.02	.9018
DECISION FACTORS.....	- 5.0292	18.15	.0028
INDIVIDUAL CHARACTERISTICS..	- 1.581e-08	28.20	.0000

Table 7.6

FINAL LOGIT MODEL FOR
AWARE WOOD NONADOPTERS/WOOD ADOPTERS

Logit Estimates — Number of obs = 52
chi2(2) = 28.20
Log Likelihood =-5.470e-08 — Prob > chi2 = 0.0000

Variable	Coefficient	Std. Error	t	Prob>|t|
Savings	52.49393	1775.903	0.030	0.977
Knowledge	34.90805	8895.525	0.004	0.997
constant	-227.7124	.	.	.

Independence -- was less straightforward than the previous comparisons. None of the coefficients had P-values below .1, so the emphasis was placed on the testing of models with different sets of variables. Long-term savings with Knowledge yielded the highest chi square (Table 7.6). The combination of Long-term savings with Independence or of Independence with Knowledge gave much smaller chi squares. Thus the model presented in Table 7.6 (Log Odds of Wood Adoption = -227.712 + 52.494 Long-term Savings + 34.908 Knowledge) would seem to be our strongest predictors. We cannot reject the null hypothesis that the coefficient for

Independence is zero. Most of the predictive power of this model is associated with Long-term Savings.

Unaware Nonadopters versus All Adopters

We should note, first of all, that there are many fewer variables included in this set of analyses. This is due, as before, to the fact that the decision variables and the values were all developed as questions specifically for those who adopted some sort of energy system. From this entire set, we can only include one of the normative variables, Total Exposure. These comments hold for all of our subsequent analyses.

In Table 7.7 we see that the Individual Characteristics are not even included. This is because there were no variables from this category which had signficant bivariate relationships with our Unaware Nonadopters/All Adopters dependent variable. On the other hand, both of the other sets of variables have significant chi squares. To test whether the coefficients for the Situational Variables are zero, we have added them to the Decision Factors. This yields an insignificant increase of 6.21 with two degrees of freedom.

Our final model is Log Odds of Adoption = -.601 + .586 Total exposure - .703 Sex. Total Exposure, the only one of the Decision Factors to be included in these last three comparisons, is the best predictor. Since its coefficient

Table 7.7

SUMMARY OF SEPARATE LOGIT ANALYSES FOR NONADOPTERS/ALL ADOPTERS

	Log Likelihood	Chi Sq	Sig
SITUATIONAL VARIABLES.....	-114.5749	7.80	.0202
DECISION FACTORS.....	-108.6753	19.60	.0000

Table 7.8

FINAL LOGIT MODEL FOR NONADOPTERS/ALL ADOPTERS

Logit Estimates — Number of obs = 188
chi2(2) = 23.67
Log Likelihood =-106.64302 — Prob > chi2 = 0.0000

Variable	Coefficient	Std. Error	t	Prob>|t|
Total Expos	.586205	.149287	3.927	0.000
Sex	-.702606	.347502	-2.022	0.045
constant	-.600850	.437882	-1.372	0.172

is positive, as the amount of exposure increases, so does the likelihood of adoption. It would appear that women are more likely to be nonadopters, since this variable is negatively related to our dependent variable.

Unaware Nonadopters versus Solar Adopters

In Chapter 6, we did find significant bivariate relationships between some of the Individual Characteristics and our Unaware Nonadopters/Solar Adopters dependent variable. However, in Table 7.9 we see that once again we cannot reject our null hypothesis that the coefficients for

these Individual Characteristics are zero. On the other hand, the Situational Variables have the highest chi square for the first time. If we add to them the Decision Factors, we see only a small, insignificant increase in our chi square. Thus, here we would conclude that the Situational Variables are our best predictors.

Table 7.9

SUMMARY OF SEPARATE LOGIT ANALYSES FOR UNAWARE NONADOPTERS/SOLAR ADOPTERS

	Log Likelihood	Chi Sq	Sig
SITUATIONAL VARIABLES.....	-18.0070	17.41	.0002
DECISION FACTORS.....	-21.5337	10.36	.0013
INDIVIDUAL CHARACTERISTICS..	-26.0736	1.28	.2587

Table 7.10

FINAL LOGIT MODEL FOR UNAWARE NONADOPTERS/SOLAR ADOPTERS

Logit Estimates — Number of obs = 39
chi2(2) = 22.17
Log Likelihood =-15.627978 — Prob > chi2 = 0.0000

Variable	Coefficient	Std. Error	t	Prob>|t|
Total Exposure	1.24361	.556870	2.233	0.032
House Age	- .08459	.035582	-2.377	0.023
constant	-2.49651	1.680905	-1.485	0.146

Table 7.10 shows that only two variables are included in our final model (Log Odds of Solar Adoption = 2.497 + 1.244 Total Exposure - .085 House Age). This time, most of the predictive power, as evidenced by the size of the coef-

ficients, is from Total Exposure. As the amount of exposure to decent-ralized alternatives increases, there is a greater like-lihood that the respondent will be a solar adopter. House Age also meets our basic standard for inclusion in the model. As the age of the home decreases, the respondent is more likely to be a wood adopter.

Unaware Nonadopters versus Wood Adopters

Table 7.11 shows us that once again the Decision Factors have the highest chi square. But considered seperate ly, the Individual Characteristics are also significantly

Table 7.11

SUMMARY OF SEPARATE LOGIT ANALYSES FOR
UNAWARE NONADOPTERS/WOOD ADOPTERS

	Log Likelihood	Chi Sq	Sig
DECISION FACTORS.....	-47.9370	8.17	.0043
INDIVIDUAL CHARACTERISTICS..	-49.9199	4.20	.0404

Table 7.12

FINAL LOGIT MODEL FOR
UNAWARE NONADOPTERS/WOOD ADOPTERS

Logit Estimates — Number of obs = 93
chi2(2) = 11.23
Log Likelihood =-46.403549 — Prob > chi2 = 0.0036

Variable	Coefficient	Std. Error	t	Prob>|t|
Total Exposure	.6421127	.2607796	2.462	0.016
Meet Ends	.3223822	.1897758	1.699	0.093
constant	-1.449515	.8415402	-1.722	0.088

different from zero. Our best set of predictors is the Decision Factors. The addition of the Individual Characteristics results in an insignificant increase in the chi square. None of the Situational Variables had significant bivariate relationships in Chapter 6, so they have not been included in this analysis.

Turning to Table 7.12, we see that our best model incorporates Total Exposure and Can't Meet Ends (Log Odds of Wood Adoption = -1.450 + .642 Total Exposure + .322 Can't Meet Ends). The degree of exposure to decentralized alternatives increases the likelihood that the respondent will be a decentralized adopter. Similarly, as the feeling that energy prices makes it difficult to meet ends increases, so does the likelihood that the respondent will be a wood adopter.

Summary

Table 7.13 provides two separate summaries. First of all, if we look at the major groups of variables, we can see which of these groups have significant chi-squares. From this we know only that their coefficients are not zero (i.e., we reject the null hypothesis in these instances). This does not imply that the group of variables was necessarily the best set of predictors. In looking at the analysis this way, we see that the Decision Factors play a role in every one of our analyses. The Situational Var-

Table 7.13

SUMMARY OF SIGNIFICANT VARIABLES

	Comparison					
	1	2	3	4	5	6
SITUATIONAL VARIABLES		*		*	*	*
Age						
Sex				*		
Marital Status						
Duncan SEI						
Family Income						
Education						
Year Purchased						
House Age					*	
House Size						
DECISION FACTORS	*	*	*	*	*	*
Initial Cost		*				
Long-term Savings						
Tax Credits						
TOTAL EXPOSURE				*	*	*
Relative Owned One						
Owned One Before						
Salesperson's Adv						
Relative's Advice						
Engineer's Advice		*				
Builder's Advice						
Demonstration Home						
Newspapers						
INDIVIDUAL CHARACTERISTICS	*	*	*			*
Science Helps						
Can't Meet Ends		*				*
Use As Affordable	*					
Raise Taxes						
Shortage Inevitable						
PLENTY						
NOSOLAR						
NONUKES						
TOOTECHY						
Independence	*					
Clean Energy						
Innovative Tech						
DOGMATIC						
KNOWLEDGE						

iables and the Individual Characteristics were significantly different from zero in four out of the six analyses.

The second way of looking at this table is to look at the variables singly. We have starred the variables which had P-values below .1. There are generally only one or two variables in each analysis which contribute most of the predictive power (given the size of their coefficients).

The results are inconclusive. When we are comparing different types of adopters (our first three comparisons), price considerations played a role while they were entered into the analyses. In addition, some of the attitudes remained in the models and Independence was included in the first comparison.

In our latter three comparisons, there is a clearer pattern. Here we see that Total Exposure is included in every final model. We also note that the situational characteristics had more predictive power in these comparisons between adopters and unaware nonadopters. We shall discuss the relevance of these findings in the next chapter.

CHAPTER 8

Conclusions

Introduction

This study has been presented as purely exploratory in nature. The sample is small, non-random, and limited both temporally and geographically. Because of this, we cannot generalize from this study to other situations. However, we can make some broad conclusions regarding the applicability of the general model which we have developed and its relationship to our theoretical formulations.

In this chapter we will discuss three separate issues. The first of these is the way in which our findings might support or weaken previous research. Since the development of our model was informed by such a wide variety of prior research, we will discuss the relevance of our findings for these studies as they relate to our different subset of variables. Our second task in this chapter will be to discuss the relevance of this study to the numerous theoretical approaches to the adoption of energy alternatives. Finally, we will discuss the implications for future research.

Relevance to Prior Studies

Situational Characteristics

The primary question which needs to be addressed in this context is whether or not solar and wood adopters are distinctly different from other groups. Many past studies have argued that solar adopters, in comparison to the general population, are younger, have an above average income, are generally from professional and managerial positions, have a higher socio-economic status, and have an above average education. In keeping with criticisms which state that this comparisons of adopters to the general population will be innaccurate because not everyone owns a home, we have been comparing our decentralized adopters with other homeowners.

The results here suggest that our solar and wood adopters are not distinctly different from other homeowners. When we look at the situational characteristics of individuals, we see only two significant bivariate relationships. There was a significant difference between the centralized adopters and the decentralized adopters in terms of age. There was also a significant difference in gender between unaware nonadopters and adopters. Sex was the only one of these individual demographics to be included in our final logit models.

We find many more significant differences between the

means when we look at the characteristics of houses. The age of the home had a significant bivariate relationship with all of our dependent variables except the unaware non-adopters/wood adopters comparison. We would be less likely to find differences here since homes are more readily retrofitted with wood. The year in which the home was purchased showed significant differences in both of our solar comparisons as well as in our comparison of different types of adopters. In our logit comparisons, we find that only house age shows up in our final models, and that only once -- in comparing solar adopters with unaware solar adopters.

All of his would tend to support the Fahrar-Pilgrim findings, which state that demographic differences are not great enough to give us a real idea of purchasers. More to the point, Warkov says that demographics correlate highly with initial interest but explain little of the difference between adopters. Here we might qualify that statement by saying that the demographic characteristics of the respondents explain little of the difference between adopters and our other categories. Thus, in order to really understand the differences between these groups, we need to look at other characteristics as well as the way in which people make decisions.

Decision Factors

Price Factors. One of the more important issues we

have had to address in this dissertation is the fact that while there is general support for solar among the population, this is not readily translated into adoption of solar alternatives. A variety of reasons have been offered: people are not motivated to invest for the long term, initial costs are too high, and the marginal utility of long-term savings decreases with increasing levels of income. We have found some support for the first two of these considerations, but little evidence to support the latter.

In all of the bivariate comparisons which we made where long-term savings could be included as a variable (the first three comparisons), there was a significant difference between the groups. In our logit analyses, it was included in our final model for the solar adopters/aware solar nonadopters comparison. Of course, sometimes it acted to encourage people, and sometimes it tended to discourage them. We shall discuss the implications of this further in the next section.

Initial cost never played as big a role as long-term savings, but it has shown up in many of our comparisons. It did tend to discourage those people who thought about solar or wood and then decided not to adopt. On the other hand, it was a positive factor in the decisions of those who did decide to adopt these alternatives.

This lack of consistency in both of these variables points to two different possibilities: either decisions are also being affected by income levels, and nonadopters

have higher discount rates or reduced marginal utility due to their higher income, or the subjective perception of the cost factors differs greatly for the adopters and the aware nonadopters. We have found little evidence to support the contention that income plays an important mediating role. There have been no significant differences on this variable in any of our comparisons. The effect of a higher discount rate might be in evidence (given the role of long-term savings) but this should not be a factor for groups of approximately equal income. Similarly, while the marginal utility of savings might decrease as income levels increase, this should not vary for people of similar income levels. Thus, to fully understand this phenomenon, we will have to eventually look at a variety of other non-cost considerations.

Norms and Habit. The main question which we were addressing in this section was whether or not the perceived acceptability of an alternative energy system affects the rate of adoption. As we mentioned in earlier chapters, models of market penetration as well as the adoption of innovation literature both assume that purchase is a function of the number of previous adopters. We employed two variables to tap into this issue: the influence of relatives who owned similar systems and the total number of people the respondent knew who owned decentralized systems (assuming that knowing more people with any type of decentralized

system would make the adoption of any decentralized system seem more acceptable).

In our comparison of centralized and decentralized adopters, we found no difference between the groups with regard to either of these variables. From this we can conclude that both groups know about the same number of decent-ralized adopters (actually, decentralized adopters knew more, but the level of significance was .058) and that the relatives had a positive influence on adoption, but the adopters of decentralized systems may have been the only ones with relatives who had also adopted. We can make this latter assumption because for both groups the influence of relatives was slightly positive, thus the purchasers of centralized systems were being influenced positively by relatives who owned centralized systems and the purchasers of decentralized systems were likewise being influenced by owners of similar systems.

On the other hand, we need to also ask whether or not people could be discouraged by knowing someone who had a decentralized system. This would not seem to be the case since for aware nonadopters of both wood and solar, this variable still had a positive impact, although it was less positive than for the adopters. At least it was not discouraging.

One of the findings which seems to stand out the most is the fact that nonadopters know significantly fewer decentralized adopters than is the case for the adopters.

This would lend considerable support to the adoption of innovation literature, although the contention in the literature is that **selective** exposure, resulting from past experience, has an effect on adoption. Here we can argue that **exposure** has an effect on adoption. It would seem to be what sensitizes people to possibilities associated with alternatives since we found significant bivariate relationships in all of the comparisons between adopters and unaware nonadopters but not when we compared different types of adopters and aware nonadopters. We have not addressed whether or not that exposure is the product of past experience, values, or psychological characteristics.

Of course, we do have a measure of past experience -- the impact of having previously owned a system of the type under consideration. This was slightly discouraging for both centralized and decentralized adopters, yet, obviously, both groups decided to adopt again in spite of this fact. For the aware nonadopter comparisons, this was discouraging for nonadopters (and may have deterred their adoption) and it was a significantly more positive influence on those who adopted (especially in the wood comparison).

All of this evidence would lead us to the early conclusion that prior ownership by relatives or friends or having owned one before is a strong determinant of subsequent action, but that other variables must be intervening. On the other hand, one of those intervening variables

might well be total exposure, given its apparent importance in sensitizing people to available alternative. If people are even adopting systems which they had some dissatisfaction with previously, then it may well be that they do not know about other options. It may, of course, also be due to the information which they receive about those options, an issue to which we now must turn.

Information. We argued earlier that the dissemination of information was strongly influenced by communication patterns. Darley and Beniger have said that interpersonal networks are important early and the modeling plays a more important role in the later stages of the adoption process. Similarly, Shama says that imitation spurs later adopters.

Here we have not addressed the temporal aspects of this question. However, we can discuss the relative importance of primary contacts (relatives), secondary information (salespersons, builders, and engineers), the media (newspapers and magazines), and modeling (demonstration homes).

Dealing with the latter first, demonstration homes are probably not very widespread at this point. Responses hovered around the no impact score and were not very different for our various groups.

Newspapers played a role in two out of our first three comparisons. Newspapers positively influenced both centralized and decentralized adopters. Of course, once again

that may be the result of selective exposure. There were also significant differences between aware wood nonadopters and wood adopters, but no real difference between solar adopters and nonadopters. On the other hand, both solar adopters and solar nonadopters said that newspapers positively influenced their decisions, and their responses were higher than for the wood adopters and nonadopters. It was the **difference between the groups** which was significant in the wood comparison, not the size of the impact. This means that people who look into solar are finding information in the media and that information tends to positive.

We must also look at the impact of primary and secondary groups on this decision process. Our first question was whether or not the information from primary groups would have more of an impact than that from secondary groups. Relative's advice was positive for all groups of adopters as well as generally positive for all nonadopters. The only significant difference was found between the solar adopters and nonadopters.

On the other hand, one of our major concerns is that the building industry is a major deterrent to the adoption of decentralized alternatives. This would appear to be the case since those who decided not to adopt said that the information from these people was decidedly negative. The information was positive for those who decided to adopt either wood or solar, implying that there are some builders and engineers who are supportive of the alternatives. Ad-

vice from engineers was the only variable from this group to be included in any logit model. Given the decentralized nature of the industry, it might be very difficult to find supportive engineers and builders even if one is inclined to adopt a decentralized alternative.

From this we might conclude that the secondary sources are an important aspect of this adoption process. Their advice is deemed as important as the advice of relatives, but it is often deters the adoption of decentralized alternatives.

To summarize to this point, much of what we have looked at could be seen as confusing. Frequently, even though there have been differences between the means for many variables, most variables still encourage adoption. The ones which do not are the price factors (in particular long-term savings) and information from secondary sources. In our logit analysis, these are the same variables which show up in our comparisons of specific subgroups. The solar logit showed us the importance of engineers advice and savings. Thus, it would seem that any model of the adoption process must include these factors. Of course, there is also a compelling case for the inclusion of other non-cost considerations like attitudes and values. We turn to these in the next section.

Individual Characteristics

Values. In numerous studies, it has been argued that values may be incentives or constraints. Leonard-Barton, Warkov, and Unseld and Crews have all argued that this may be especially true in the adoption of energy alternatives. We tend to find some support for these contentions in the results of this study (although we cannot discuss the results of this study in comparison to the adoption of technologies other than energy).

We have found significant differences between adopters and aware nonadopters, as well as between centralized and decentralized adopters, on both the desire to be independent as well as the value of clean energy. Independence was included in the final logit model for the centralized/decent-ralized comparison. In addition, independence was the last variable removed in the solar comparison.

On the other hand, we find no evidence to support the idea that innovativeness is an important consideration. Perhaps we have moved beyond the early adopters stage, and those who are adopting now are relying more on modeling (which supports the conclusions of the previous section). Of course, we cannot answer this question, but the conclusion seems reasonable given our findings so far.

All of this, then, would lead us to believe that values play an important role in this process. But there may be important mediating factors found in the conflicting

signals which people get regarding the energy crisis itself. Let us now turn to those variables.

Attitudes. There were many attitudes which could affect the process of adoption. Let us deal with them one at a time. First, Leonard-Barton says that a belief in the seriousness of the energy crisis is an important motivating factor. Similarly, others have argued that perceptions concerning amount of oil that remains may also be determining factor. We had three different measures of this: Shortage, Science Helps (because this belief would mitigate the seriousness of the energy problem), and PLENTY.

We have found that, at least in some instances, these have shown significant differences between the means in our bivariate comparisons. All three had significant differences in our comparison between centralized and decentralized adopters. Science Helps and PLENTY also had signficant relationships in our aware nonadopter/wood adopter comparison. However, none of them show up in any of our final logit models, thus their predictive power is limited.

It has also been argued that a belief in environmental activism may affect adoption of energy alternatives. Here we examined two related variables: the belief that people should use as much energy as they can afford (a low score implying that people should act to conserve) and raising taxes as a means of forcing people to become environmental-

ly active. Again, both of these show up in various comparisons, but not in any of the logit analyses, implying that they contribute relatively little predictive power.

We could also argue here that we find little support for Olsen's contention that favoring of voluntary versus mandatory measures could also be linked to adoption. We find here that there is equally little support for either of these alternatives, although the degree of nonsupport may vary from group to group.

Along the same lines, it has been argued that feeling personally affected would increase the likelihood of adoption. Our measure of this, energy prices make it difficult to make ends meet, shows up only in our comparison of solar adopters and solar nonadopters. It would seem that those people who have adopted solar alternatives now feel that they are less vulnerable to price increases.

Along a different line, the argument has also been made that these general attitudes would probably have less relevance to the actual purchase of a decentralized alternative than would specific attitudes regarding the viability of, or support for, various energy alternatives. To examine this, we have developed three different scales: one measuring support for nuclear (the ideal typical centralized alternative), one measuring attitudes about the viability of solar, and one measuring whether or not people thought that solar was just too technical for them to use.

NOSOLAR showed significant differences between groups

in both of the solar comparisons, as might be expected. Both NOSOLAR and NONUKES had signficant differences between the means in the centralized/decentralized comparison. These are the only bivariate relationships where these variables played a role, and none of the specific attitudes were included in any of the final logit models. This result could demonstrate one of two things: either the theoretical assumption is wrong and the general attitudes are more closely tied to adoption than the specific ones, or, alternatively, these are measures are actually still too general or they have low validity. The latter is assumed here to be the case.

Knowledge and Dogmatism. We had assumed that the amount of knowledge about energy issues would affect the rate of adoption. We find that there are significant difference between centralized adopters and decentralized adopters as well as between wood adopters and nonadopters, but not in any other comparisons. Apparently the solar nonadopters are very similar to adopters on a variety of characteristics, including their knowledge of energy issues. It is a little more difficult to explain the lack of difference between nonadopters and adopters. Perhaps this is indicative of the fact that the general population is knowledgeable about energy, they just need to see it working somewhere to become sensitized to its viability.

There were significant differences between groups on

our dogmatism scale in only two comparisons: centralized/decentralized and wood adopters/wood nonadopters. The centralized adopters and the wood nonadopters both demonstrated higher scores on this scale, lending some credence to the claim that nonadoption may be due as much to individual idiosyncrasies as it is to failures of the system.

To summarize to this point, there were numerous attitudinal and value variables which appear to contribute to our understanding of the differences between decentralized adopters and nonadopters. And in general, these sets of variables were better at distinguishing between groups than the decision factors which we had developed or the demographic characteristics of the adopters. To draw some of the implications for theory, we turn to our next section.

Implications for Theory

Here we will discuss in turn the implications for the various theoretical approaches presented in Chapters 2 and 3 as well as what this portends for the environmental movement as a whole. First let us discuss some of the models of consumer behavior, including the underlying economic assumptions, and then turn to the adoption of innovations literature.

We discussed three different models of consumer behav-

ior in Chapter 2. The first of these was the model of consumer sovereignty. In this model the argument is made that consumers make independent decisions based on their values. At first glance, much of the evidence presented in this dissertation would tend to support this theory. Values, especially of those which favor independence or clean energy, played an important role. But we must recall that in this model, values are simply reflected in price factors; if people make a purchase, then it must fit into their values. Here we can point more specifically to the relative impact of values and prices. Price issues such as long-term savings and initial cost were major deterrents for those who decided not to purchase decentralized energy systems, but Independence was also a positive considertion for many who chose to ignore the drawbacks of the initial investment.

We need to examine the underlying assumptions of this approach in more detail. If we can make the assumption, as we do here, that our variable long-term savings is an indicator of the respondents discount rate, we find that the discount rate would be higher for those who decide not to purchase decentralized systems. But since there were no real differences between our respondents in education, income, or occupation, it would seem that this higher discount rate is not the product of any objective considerations but instead reflects the subjective non-cost considerations which seem to inevitably affect the decisions of

all purchasers. Certainly the risk is high if the price is high, the commitment is long in the purchase of most of these systems, but these considerations hold true as much for adopters as for nonadopters. Thus, as Simons has so eloquently argued, what we need to do is examine the "inner environment".

Thus we turn to our second model, manipulated consumption. In this approach the assumption is that decisions are not simply influenced by prices but are also the result of example, custom, suggestion, etc. We find a great deal of support for this theory. The impact of TOTAL EXPOSURE or the fact that a relative may have owned a system has been consistent throughout the analyses. And regardless of what type of adoption was taking place, the decision maker was influenced by normative expectations.

Of course the role of the media in this would lead us to assume that consumption is not being manipulated since many adopters have been positively influenced by the information which they found in newspapers. This would imply that needs, at least, are not being shaped by the media. However, individuals are still more likely to have their needs met if they purchase systems that are in general use. Builders and engineers are more familiar with, and thus can more readily install and repair, conventional energy systems. This could lend more support to Scitovsky or it could be seen as relating to the final model of structured consumption.

In structured consumption, purchasers make decision based on the perceived alternatives. Here we argue that nonadopters (aware nonadopters as well as unaware) perceive fewer alternatives because they are so difficult to come into contact with (so disperse) or because of the influence of "professionals" whom they trust. This is further reflected in the NOSOLAR findings. The fact that groups of such similar demographic characteristics can have such vastly different perceptions of the same energy systems must reflect the structure of the market -- not only prices but also information.

This leads us to a discussion of the adoption of alternatives literature. One of the cornerstones of this approach -- both in theory and in practice -- is that information, either personal or impersonal depending on the stage of adoption, is an important correlate of adoption. Certainly we find evidence of that in our data. We also can support the assumption that price considerations are important as well as that the innovation under consideration must be compatible with the adopters values. Many of the other considerations we have not tested for, but one in particular remains unresolved.

Rogers has said that we should not be so quick to place blame for nonadoption on the failure of the individual. Rather, we need to also look at the possibility of system failure. Here we see some indication of both. Dogmatism played a role in our centralized/decentralized com-

parison as well as in our wood adopters/nonadopters comparison. On the other hand, the fact that some builders and engineers are so discouraging implies some problems with the industry. There is no way to resolve that issue here.

There is also some support, although tentative, for continuing to examine the relationship between attitudes and behavior. Here we have many significant bivariate relationships between either general or specific attitudes and some of our dependent variables. This would tend to support Simons' criticisms of neoclassical economic theory. With regard to Fishbein's argument that there will only be a connection between specific attitudes and a specific behavioral intent, we can only argue that here we have found some connections between general attitudes and a concrete behavior.

Finally, what does all of this imply for the environmental movement. Recall that this study was initiated by Lovins' contention that the values necessary for the diffusion of decentralized energy systems currently exist and that what is necessary is that we begin to substitute one technology for the other. We now have two comments to make with regard to this claim. Certainly the values that he mentions exist, but it would seem that the assertion is limited (as we stated in the first chapter). While the values may exist, they are not necessarily of equal importance for all people. And there are considerable dif-

ferences of opinion regarding a variety of attitudes which might also be connected with adoption.

Our second comment concerns his implicit faith in the effectiveness of markets. It would seem that here the concerns of Darley and Beniger carry the day. They have argued that the unassisted operations of a free market will not result in the maximization of environmentally sound behavior because of high discount rates, high initial costs, etc. In addition, we would argue here that the market will continue to be biased due to the information disseminated by builders and engineers (regardless of how we feel about the accuracy of that information).

So, what should be done? Cook and Berenberg have argued that attempts to encourage conservation (or, we could argue, the adoption of energy alternatives) have focused on two approaches: promoting pro-conservation attitudes through persuasive communication or evoking attitude consistent behaviors. It would seem that, given this data, the former would be more important. The main problem seems to be that nonadopters attitudes do not support solar adoption (in contrast, once again, to Lovins' claim).

Of course, we should also begin to look at the broader context of adoption. For example, we should begin to see how politics affects the adoption process. But that will have to be left for future research.

Implications for Future Research

Our primary task in this dissertation was to sort through the various theories of behavior which seemed to apply to the adoption of energy systems in order to develop a model which would sensitize us to the variety of factors which might affect people's decisions regarding whether or not they should purchase a conventional energy system or a nonconventional, decentralized system. To help us in this task, we also organized the findings of other pertinent studies in the context of the general model. In this way, we could look for specific values, attitudes, information channels, etc. which seemed relevant to our study.

We could conclude here that the model has generally held up fairly well. By this, we mean not that all of the variables in the model have significant relationships to our dependent variables. This was never expected. Rather, we mean that the model forced us to include variables from many different areas, and the results have demonstrated that the narrow reliance on any one type of variable -- demographics, price variables, attitudes, or values -- is an inadequate approach. What we apparently need to do is rely on variables from all of these areas to enrich our understanding of this process. That, of course, was also the fundamental theoretical approach. Furthermore, few studies have drawn the links between values and energy systems in such a specific manner.

The first step in following up on this study would be to try to gain further support for the general approach taken with this model by conducting a truly random sample of homeowners in different regions of the country. Having a sample that is not truly random and is limited to the state of New Hampshire at a time when energy issues were still on the minds of many people means that we cannot generalize from this study to any other group of people.

In this follow up study, some specific changes might also be made in measurement. The most obvious is the measure of family income. By relying on general categories of income rather than the real dollar value, this variable became clouded. It would seem to be more prudent to retain as much information about the variables as possible.

Second, some of the attitudes might be measured with more clarity. There is a strong possibility that the variable TOOTECHY had no impact because of the fact that very different kinds of attitudes showed up on this factor (i.e., the inclusion of Big Investment with questions oriented more to the technology). Clearer measures of attitudes may only enhance what already appears to be an important group of variables.

Some links still need to be drawn between this model, which focuses on the behavior of people on the micro level, and the more macro level behavior of political and social systems. Originally, we were going to also look at some indicators of macro level variables -- federal support for

research and development, the absolute price of oil (not the perceived price), the number of solar homes in the state, etc. This became an unwieldy process at this point, but it might be easier to make some judgment about the subjective interpretations of individuals if they were balanced by objective facts.

Finally, it might also be instructive to compare the results of this approach as it applies to energy systems with the results if it were applied to other innovations. The validity of any model is enhanced if it can be applied to a wide variety of situations.

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APPENDIX

QUESTIONNAIRE

1. Questionnaire No.____

2. Your age:____

3. Your sex: M F

4. Marital status: Married Single Divorced Separated Widowed

5. Number of children:____

6. Your occupation:_____

7. Your approximate annual income: (circle one)

0- $6,000 $6,001-$12,000 $12,001-$18,000 $18,001-$24,000
$24,001-$36,000 $36,001-$48,000 $48,001-$72,000 over $72,000

8. Spouse's age:___

9. Spouse's occupation:_____

10. Spouse's approximate annual income: (circle one)

0- $6,000 $6,001-$12,000 $12,001-$18,000 $18,001-$24,000
$24,001-$36,000 $36,001-$48,000 $48,001-$72,000 over $72,000

11. Please circle the highest level of education which you have completed:

1 2 3 4 5 6 7 8 9 10 11 12 Some college B.A./B.S. Some graduate work

12. Do you share responsibility for this household with someone other than a spouse?

___YES ___NO

If yes, please answer the following questions regarding this person:

13. Age:____

14. Sex: M F

15. Occupation:_____

16. Approximate annual income: (circle one)

0- $6,000 $6,001-$12,000 $12,001-$18,000 $18,001-$24,000
$24,001-$36,000 $36,001-$48,000 $48,001-$72,000 over $72,000

17. Do you own your home or are you a renter?

___Owner ___Renter (If you rent, skip to number 65, otherwise continue.)

18. If you own your home, in what year was it purchased?____
19. Approximately how old is the home in which you are now living?_____years
20. Not including bathrooms, how many rooms are in your home?_____

In the following sections we would like to find out what type of home heating you have (oil, coal, natural gas, electric, wood, active or passive solar, etc.) and ask you a few questions about that energy source. Next to number 21, write the name of your primary source of heat along with a description (forced hot air, hot water, super insulated or envelope home, etc.) and then answer the questions which follow. If you own more than one home energy source, use the next section (beginning with question 43) in a similar manner.

21. PRIMARY ENERGY SOURCE:_____ DESCRIPTION:_____

22. Approximately how much of your heat comes from this source?____%
23. How satisfied have you been with this heat source? (circle one)
Very satisfied Somewhat satisfied Somewhat dissatisfied Very dissatisfied

How did you acquire this item?

___24. Had it built into the design of the house. Year:____ (go to #27)
___25. Installed after the house was purchased. Year:____ (go to #27)
___26. Acquired with the house. Year:____ (go to #43 or #65)

27. How much of this did you build or install yourself? 0 10% 25% 50% 75% 100%

Many things may have influenced your decision to purchase this form of heat. Some may have tended to encourage your purchase, some may have discouraged you. Below is a partial list. On a scale of 0 to 4 (0 = did not affect your decision, 1 = very discouraging, 4 = very encouraging), please indicate the amount of influence that each of these factors had on your decision.

		No Impact	DISCOURAGING Very	DISCOURAGING Somewhat	ENCOURAGING Somewhat	ENCOURAGING Very
28.	Initial cost	0	1	2	3	4
29.	Potential long-term savings	0	1	2	3	4
30.	Tax credits	0	1	2	3	4
31.	You owned one before	0	1	2	3	4
32.	Advice from an equipment salesperson	0	1	2	3	4
33.	Advice from a relative or friend	0	1	2	3	4
34.	A relative or friend owned one	0	1	2	3	4
35.	Advice from an engineer or architect	0	1	2	3	4
36.	Advice from a builder or contractor	0	1	2	3	4
37.	A demonstration home	0	1	2	3	4
38.	Newspapers or magazines	0	1	2	3	4
39.	Greater energy independence	0	1	2	3	4
40.	Clean, safe energy	0	1	2	3	4
41.	Innovative technology	0	1	2	3	4
42.	Other:_____	0	1	2	3	4

43. SECONDARY ENERGY SOURCE:_____ DESCRIPTION:_____

44. Approximately how much of your heat comes from this source?_____%

45. How satisfied have you been with this item? (circle one)

Very satisfied Somewhat satisfied Somewhat dissatisfied Very dissatisfied

How did you acquire this item?

___46. Had it built into the design of the house. Year:____ (go to #49)
___47. Installed after the house was purchased. Year:____ (go to #49)
___48. Acquired with the house. Year:____ (go to #65)

49. How much of this did you build or install yourself? 0 10% 25% 50% 75% 100%

Many things may have influenced your decision to purchase this form of heat. As above, on a scale of 0 to 4 please indicate the extent to which the following factors tended to encourage or discourage your purchase.

		No Impact	DISCOURAGING Very	DISCOURAGING Somewhat	ENCOURAGING Somewhat	ENCOURAGING Very
50.	Initial cost	0	1	2	3	4
51.	Potential long-term savings	0	1	2	3	4
52.	Tax credits	0	1	2	3	4
53.	You owned one before	0	1	2	3	4
54.	Advice from an equipment salesperson	0	1	2	3	4
55.	Advice from a relative or friend	0	1	2	3	4
56.	A relative or friend owned one	0	1	2	3	4
57.	Advice from an engineer or architect	0	1	2	3	4
58.	Advice from a builder or contractor	0	1	2	3	4
59.	A demonstration home	0	1	2	3	4
60.	Newspapers or magazines	0	1	2	3	4
61.	Greater energy endependence	0	1	2	3	4
62.	Clean, safe energy	0	1	2	3	4
63.	Innovative technology	0	1	2	3	4
64.	Other:_____	0	1	2	3	4

Below are a few statements concerning energy consumption. For each statement, please indicate whether you think it is true or false.

65.	Turning down the heat at night saves less energy than it takes to reheat the house in the morning.	TRUE	FALSE	DON'T KNOW
66.	On a per person basis, energy consumption in the United States is still the same as it was in 1960.	TRUE	FALSE	DON'T KNOW
67.	When you consider both energy costs and mortgage payments, passive solar homes cost more than traditional homes.	TRUE	FALSE	DON'T KNOW

Next there are a few statements about energy related matters. Please indicate your opinion according to the following scale.

5. Agree very much
4. Agree somewhat
3. Neutral
2. Disagree somewhat
1. Disagree very much
DK Don't know

		AGREE			DIS-AGREE		
68.	The biggest problem with solar power is that it requires such a large initial investment	5	4	3	2	1	DK
69.	Solar power will never make a significant contribution to our energy needs	5	4	3	2	1	DK
70.	Scientists will be able to develop new forms of energy before we have another crisis	5	4	3	2	1	DK
71.	Only people with a lot of mechanical ability should own a solar home.	5	4	3	2	1	DK
72.	Energy prices make it extremely difficult for my family to make ends meet	5	4	3	2	1	DK
73.	The solar technology now on the market will probably be obsolete in 5-10 years.	5	4	3	2	1	DK
74.	People should be allowed to use as much energy as they can afford.	5	4	3	2	1	DK
75.	While solar homes are great for warm, sunny climates, it is too cold and cloudy for them where I live	5	4	3	2	1	DK
76.	While some may disagree, I think nuclear power is safe and we should be putting even more money into it.	5	4	3	2	1	DK
77.	We need not worry about future energy shortages because America has such a wide variety of resources.	5	4	3	2	1	DK
78.	The government should place higher taxes on gas and oil in order to discourage consumption.	5	4	3	2	1	DK
79.	The government should immediately begin to at least double its funding for solar research and development . . .	5	4	3	2	1	DK
80.	This country probably has enough oil for centuries, we just need to find it	5	4	3	2	1	DK
81.	We should immediately put a stop to the building of all nuclear power plants.	5	4	3	2	1	DK
82.	Another energy shortage seems to be almost inevitable . . .	5	4	3	2	1	DK

Here are a few general statements which people might make. Please indicate your opinion according to the same scale.

83.	In this complicated world of ours, the only way to know what's going on is to rely on leaders or experts who can be trusted.	5	4	3	2	1	DK
84.	I get really angry when a person stubbornly refuses to admit that they are wrong	5	4	3	2	1	DK
85.	There are two kinds of people in this world: those who are for the truth and those who are against it.	5	4	3	2	1	DK
86.	Of all the different philosophies which exist in this world, there is probably only one which is correct	5	4	3	2	1	DK

Below is a list of items which you may have seriously considered buying and then decided against. If so, please put a check next to that item.

___ 87. Photovoltaic collectors
___ 88. Solar hot water equipment
___ 89. A passive solar home: _____
___ 90. Greenhouse
___ 91. Wood stove/furnace

If you checked any of the above items, please indicate how important the following factors were in your decision. If you checked more than one item, please answer for the one which you most seriously considered and indicate which one that is in the space below. As before, on a scale of 0 to 4 please indicate the degree of influence which each of these factors had on your decision. If you did not check an item, go to 107.

Item: _____

		No Impact	DISCOURAGING Very	Somewhat	Somewhat	ENCOURAGING Very
92.	Initial cost	0	1	2	3	4
93.	Potential long-term savings	0	1	2	3	4
94.	Tax credits	0	1	2	3	4
95.	You owned one before	0	1	2	3	4
96.	Advice from an equipment salesperson	0	1	2	3	4
97.	Advice from a relative or friend	0	1	2	3	4
98.	A relative or friend owned one	0	1	2	3	4
99.	Advice from an engineer or architect	0	1	2	3	4
100.	Advice from a builder	0	1	2	3	4
101.	A demonstration home	0	1	2	3	4
102.	Newspapers or magazines	0	1	2	3	4
103.	Greater energy independence	0	1	2	3	4
104.	Clean, safe energy	0	1	2	3	4
105.	Innovative technology	0	1	2	3	4
106.	Other: _____	0	1	2	3	4

Next to each of the following items, please indicate how many people you know who own a product of this type. (For example, __2__ Wood stove would mean that you know 2 people who own a wood stove.)

___ 107. Photovoltaic collectors
___ 108. Solar hot water equipment
___ 109. A passive solar home: _____
___ 110. Greenhouse
___ 111. Wood stove/furnace
___ 112. Windmill

There are many ways by which the federal and state governments can aid the spread of new energy systems. Below is a partial list. Please indicate how strongly you would support or oppose such actions by the government according to the following scale:

5. Support very strongly
4. Support a little
3. Neutral
2. Oppose a little
1. Oppose very strongly
DK Don't know

		SUPPORT 5	4	3	OPPOSE 2	1	DK
113.	Tax credits or deductions	5	4	3	2	1	DK
114.	Low interest loans	5	4	3	2	1	DK
115.	Guaranteed loans	5	4	3	2	1	DK
116.	Property tax exemptions	5	4	3	2	1	DK
117.	Research grants	5	4	3	2	1	DK
118.	Reduced property assessments	5	4	3	2	1	DK
119.	Energy seminars	5	4	3	2	1	DK
120.	Publications	5	4	3	2	1	DK
121.	Demonstration homes	5	4	3	2	1	DK
122.	Setting equipment standards	5	4	3	2	1	DK
123.	Requiring minimum warranties	5	4	3	2	1	DK
124.	Licensing installers	5	4	3	2	1	DK

Following is an alphabetical list of 16 values. On a scale of 1 to 5 (1 = not at all important, 5 = very important), please indicate how important each of these values are to YOU in guiding YOUR life.

		NOT AT ALL IMPORTANT				VERY IMPORTANT
125.	A CLEAN, HEALTHY ENVIRONMENT	1	2	3	4	5
126.	A COMFORTABLE LIFE	1	2	3	4	5
127.	AN EXCITING LIFE	1	2	3	4	5
128.	A SENSE OF ACCOMPLISHMENT	1	2	3	4	5
129.	A WORLD AT PEACE	1	2	3	4	5
130.	EQUALITY	1	2	3	4	5
131.	FAMILY SECURITY	1	2	3	4	5
132.	FREEDOM	1	2	3	4	5
133.	HAPPINESS	1	2	3	4	5
134.	NATIONAL SECURITY	1	2	3	4	5
135.	SALVATION	1	2	3	4	5
136.	SELF-RESPECT	1	2	3	4	5
137.	SOCIAL RECOGNITION	1	2	3	4	5
138.	SOCIAL RESPONSIBILITY	1	2	3	4	5
139.	TRUE FRIENDSHIP	1	2	3	4	5
140.	WISDOM	1	2	3	4	5

Below is another list of 13 personal characteristics. Using the same scale, please indicate how important it is for YOU to be like this.

		NOT AT ALL IMPORTANT				VERY IMPORTANT
141.	AMBITIOUS	1	2	3	4	5
142.	BROADMINDED	1	2	3	4	5
143.	CAPABLE	1	2	3	4	5
144.	CLEAN	1	2	3	4	5
145.	DECISIVE	1	2	3	4	5
146.	HELPFUL	1	2	3	4	5
147.	IMAGINATIVE	1	2	3	4	5
148.	INDEPENDENT	1	2	3	4	5
149.	INFLUENTIAL	1	2	3	4	5
150.	INNOVATIVE	1	2	3	4	5
151.	INTELLECTUAL	1	2	3	4	5
152.	LOVING	1	2	3	4	5
153.	OBEDIENT	1	2	3	4	5

Using the same scale, please indicate below how important each of the following factors would be if you were to purchase a new home in New Hampshire.

		NOT AT ALL IMPORTANT				VERY IMPORTANT
154.	Attic insulation	1	2	3	4	5
155.	Wall insulation	1	2	3	4	5
156.	Storm windows and doors	1	2	3	4	5
157.	Fireplace	1	2	3	4	5
158.	Wood stove/furnace	1	2	3	4	5
159.	Southerly orientation	1	2	3	4	5
160.	Passive solar design	1	2	3	4	5
161.	Solar hot water	1	2	3	4	5
162.	Photovoltaic collectors	1	2	3	4	5
163.	Greenhouse	1	2	3	4	5

Thank you very much for your cooperation. Feel free to use the remaining space to make whatever comments you would like regarding this survey or our energy policies.